**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEBRASKA**

JULIE KEASCHALL, Personal Representative of the Estate of Kurtis Keaschall, deceased and DAWSON PUBLIC POWER DISTRICT, **Plaintiffs,** **vs.** **ALTEC INDUSTRIES, INC. and OSBORNE INDUSTRIES, INC.,** **Defendants.**	**CIVIL ACTION NO.: 4:14-CV-03070** **AFFIDAVIT OF STEPHEN L. AHL IN SUPPORT OF DEFENDANTS' MOTION FOR SUMMARY JUDGMENT**

STATE OF NEBRASKA)
)ss.
COUNTY OF LANCASTER)

Stephen L. Ahl, being first duly sworn upon oath, deposes and states as follows:

1. I am the attorney for Defendant Osborne Industries, Inc., in the above-captioned action.
2. I offer this Affidavit in support of Defendants' Motion for Summary Judgment.
3. I have personal knowledge of the facts contained herein.
4. During the course of discovery, Plaintiff has disclosed only two expert witnesses on liability issues, John A. Eihusen, P.E. and William R. Coleman, M.S., P.E.
5. Attached hereto as Exhibit A is a true and correct copy of the September 26, 2015 Report of John A. Eihusen, P.E, which Plaintiff provided during discovery in this matter.
6. Attached hereto as Exhibit B is a true and correct copy of the October 24, 2016 and November 29, 2016 Deposition of John A. Eihusen, P.E., taking during

EXHIBIT
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discovery in this matter.

7. Attached hereto as Exhibit C is a true and correct copy of the transcript of the deposition of Plaintiff's designated expert William R. Coleman, taken during discovery in this matter.

8. Attached hereto as Exhibit D is a true and correct copy of the September 30, 2015 Report of William R. Coleman, which Plaintiff provided during discovery in this matter.

9. Attached hereto as Exhibit E is a true and correct copy of the August 29, 2016 Supplemental Report of William R. Coleman, P.E., M.S.

10. Attached hereto as Exhibit F is the August 1, 2016 Rebuttal Report of John A. Eihusen, P.E., which Plaintiff produced during discovery in this matter.

11. Attached hereto as Exhibit G is a true and correct copy of the June 23, 2016 Knott Laboratory Engineering Report prepared by Osborne's designated expert Ben T. Railsback, M.S., P.E, which was produced during discovery in this matter.

12. Attached hereto as Exhibit H is the Report of Osborne's designated expert Joseph F. Rakow, PhD, P.E., which was produced during discovery in this matter.

13. Attached here to as Exhibit I is the June 27, 2016 Report of Defendant Altec Industries, Inc.'s designated expert, Anand R. Shah, M.S., M.B.A., P.E., which Altec produced during discovery in this matter.

14. Attached hereto as Exhibit J is the Altec Industries, Inc. Operator's Manual for AA755L. This document is subject to a protective order and is filed under seal.

15. On May 10, 2017, Defendants filed motions seeking to exclude the testimony of John A. Eihusen and William R. Coleman.

FURTHER AFFIANT SAYETH NAUGHT.

Stephen L. Ahl

SUBSCRIBED AND SWORN to before me, this 10th day of May 2017.

Jennifer D. Saner

Notary Public

GENERAL NOTARY - State of Nebraska
JENNIFER D. SANER
My Comm. Exp. October 8, 2020

EiCon Services

3310 Manassas PL
Lincoln, NE, 68516
E-Mail: EiCon@neb.rr.com

Keaschall Failure Investigation

Summary Findings

September 26, 2015

John A. Eihusen, PE

EXHIBIT
A

1. Scope of Work for Expert Analysis

The scope of work (SOW) was to review the evidence provided, research and investigate as necessary to determine the cause and all contributing factors for the failure of the aerial lift bucket involved in the Keachall accident. The work scope includes responding directly and specifically to the questions of interest provided below:

1) Did defendants use reasonable care in the manufacture of the bucket?
2) Did defendants use reasonable care in the design of the bucket?
3) Did defendants adequately warn of the dangers of the use of the bucket and the need for periodic inspection?
4) Was the bucket defective and unreasonably dangerous for its intended use (or for any use defendants could reasonably foresee)?
5) Were items 1-4 a cause of the collapse of the bucket?

This summary report details the investigation and findings for the failed composite man-lift bucket assembly and provides answers to the key questions of interest.

2. Standard Reference Datums and Identification

For consistency in this report a standardized reference datum is defined as an observer would view the assembly standing at the point of connection with the lift boom; facing outward and bucket open upwards.

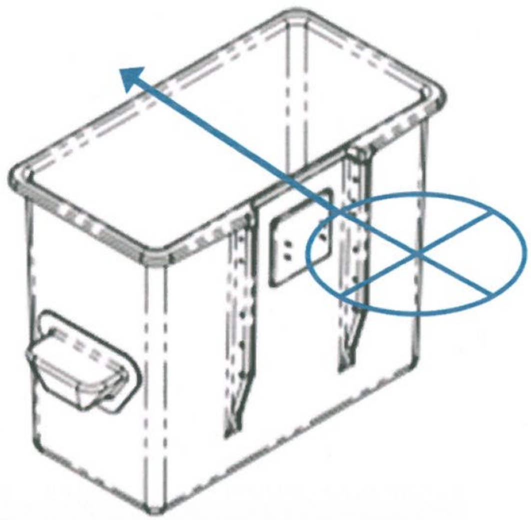

Figure 1 Reference View

The bucket is identified with the following attached label shown in Figure 2.

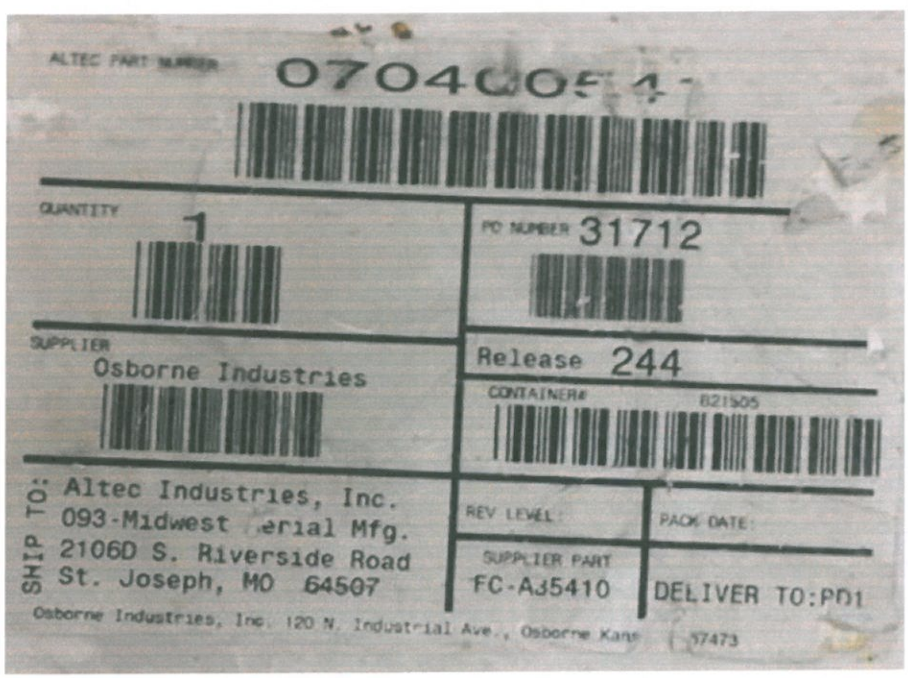

Figure 2 Identification Label

3. Statement of Expert Opinion

It is my expert opinion as an engineer in the field of composites that:

1) A delamination flaw (or structural defect) was created at the time of manufacture at the "A" Location (see Figure 6).
2) The defect was near or adjacent to the top of the pre-formed insert used to form the right side vertical rib of section 2.
3) Secondary machining operations transforming the raw molded part described in ALTEC drawing 704-00065 to the external profile on drawing 704-00350 caused external edge defects or in-plane delamination at the 18 inch rib to rib cut opening. The defects could have been facilitated by physical damage of the cutting tool or by exposing existing internal defects to the environment.
4) The internal delaminations and external machining damage was facilitated by dry fiber from incomplete resin flow and wet out of the reinforcement mat at the time of molding.
5) The incomplete resin flow resulted from improper reinforcement layup and mold closure as identified by Osborne on the units Aerial Platform Inspection Report.
6) The external flaws caused by the machining operation grew in service extending the delamination surface between plies and reducing the structural capacity of the laminate as it was used in-service until it reached the failure load condition.
7) At time of the failure the compromised composite resolving Mr. Keaschall's body weight into vertical rib failed in shear at or near the vertical rib insert which triggered the catastrophic failure of the bucket.
8) Mr. Keaschall would not have had any visual warning of the impending failure.
9) None of the inspection methods used for safety assessment "as described" in the user operating instructions would have indicated this failure mode to Mr. Keaschall.
10) The primary structure was not resistant to a single point failure mode and as such failed totally and completely in a manner inconsistent with life-critical applications.
11) The primary reinforcement used in the design and identified as short fiber, random mat has little capacity to resist flaw propagation and was improperly applied in the design without suitable long fiber reinforcement to provide fracture toughness and control of cycling tensile strains in the laminate.

4. Responses to Questions of Interest

The following sections respond to the questions of interest with a summary rational.

4.1. Question of Interest 1

Did defendants {Altec / Osborne} use reasonable care in the manufacture of the bucket?

RESPONSE: Based on the disclosures provided, No.

RATIONALE: My determination is based on lack of disclosures that indicate that the requirements of ISO 9000 were not being followed and best practices for risk management were not being applied. Minimum requirements of ISO 9000 order specific actions with respect to vendor management and certification to conformance to the purchase order. This may be implemented in numerous schemes but documentation that the lift bucket was shipped / received meeting the purchase specification was not provided. This implies that no inspection of the manufactured assembly was performed. In the ISO 9000 quality system vendor surveys and process documentation should have been in the record for the manufacture of the bucket.

Standard best practice process would be to develop PFMEAs and active CONTROL PLANS to which the manufacturing process could be audited for compliance. The CONTROL PLAN would also point to tool validation and inspection verification for all key steps. For a life critical structure not supported by comprehensive process planning (PFMEA, CONTROL PLANS, TOOL VALIDATION) with concurrent traceability of key material content is not providing "reasonable" care by any recent standard of merit.

4.2. Question of Interest 2

Did defendants {Altec / Osborne} use reasonable care in the design of the bucket

RESPONSE: Based on the disclosures provided, No.

RATIONALE: The design documentation did not provide or apparently consider a material evaluation plan to develop acceptable allowable stresses for the bucket over the design lifetime. There apparently was no comprehensive specification for the operational requirements for the lift bucket with a concurrent design analysis to verify the design intent. Some "work product" of the design authority should have evidenced design intent that a responsible individual with an understanding of the "use" and "success" in service exercised critical judgment. The preparation of an advanced analysis such as Finite Element Analysis (FEA) with a material suitable fracture assessment would have been within normal expectations for life critical structure. Altec claims the ability to perform such analysis in multiple patent disclosures for composite structures. They also clearly identify the performance improvement of long fiber, woven or knitted fabrics. The lack of those known techniques in this life critical structure would not be considered either reasonable or best practice.

In the testing of the product there is no indication of the revision level of the bucket tested or any indication how any specific test of record related to the release status and of current builds. Revision changes were issued without providing rational for changes or detailing the effect to the design verification documents. Bucket validation testing beyond the date of manufacture or revision level of the bucket supplied are not relevant to the engineering evaluation of the design and are not proof that reasonable care was applied in the design process.

As part of a design process for a life critical structure it is reasonable to expect that a DFMEA would be developed. A DFMEA would have indicated the single point failure and lack of a failure tolerant design. In this case a design was developed with out redundant load paths so that when the bucket flange was compromised the structure failed catastrophically.

4.3. Question of Interest 3

Did defendants {Altec / Osborne} adequately warn of the dangers of the use of the bucket and the need for periodic inspection?

RESPONSE: Based on the disclosures provided and the manner of this failure, No.

RATIONALE: An extensive review of the documents provided by Altec never disclosed the potential for catastrophic structural failure of the composite parts. Inspection criteria centered on the dielectric response of the composite to resist high voltage current leakage. Inspection criteria specific to the identification of unsafe use or (pass / fail) criteria for the load carrying ability of the structure was not identified. This is clearly shown in the vehicle's inspection record that several third-party inspections to published recommendations and did not find any defects in the bucket structure.

4.4. Question of Interest 4

Was the bucket defective and unreasonably dangerous for its intended use (or for any use defendants {Altec / Osborne} could reasonably foresee)?

RESPONSE: From the information disclosed, YES.

RATIONALE: By Osborne manufacturing records the bucket was subjected to known folds and visual indications at the time of manufacture. These were judged to be superficial and passed on without further inspection. The responsible review and evaluation of acceptable or repairable defects is not provided in the documentation. No evidence of evaluation of the depth or extent of the defect is recorded or part of the manufacturing record. At no point was a concurrence of the "design authority" documented to allow the observed defect to remain in the laminate. Altec as the "design authority" has a implied responsibility to ensure that proper guidance of the manufacturing process is provided. This would include continuing inspection and control of received hardware to ensure it fully meets the intended specification. There is no documentation that supports that critical and reasonable effort.

The evaluation of the defect (or an anomaly) should have been validated by systematic D/P FMEA evaluations as part of an operational Control Plan. The Control Plan would have required the validation of visual inspection indication, which in this case was the preceding "first cause" of the chaining sequence of the failure event.

4.5. Question of Interest 5

Were items 1-4 a cause of the collapse of the bucket?

RESPONSE: YES.

RATIONALE: As detailed above.

5. Evidence Reviewed

My expert opinion is based on the following:

1) Personal inspection of the failed components
2) All Documents and specifications as disclosed by Altec
    a. This includes all operations, parts and service instructions
    b. This includes all test documentation and video
3) All Documents and specifications as disclosed by Osborne
4) All Documents and inspection records as disclosed by Dawson Public Power
5) All Documents and reports as provided by Sherman County Sheriff
6) All Depositions as provided by the client (Dawson Public Power)
7) Personal research in specific application
8) Review of Altec patents and claims
9) Detail review of the photographic evidence by:
    a. Altec
    b. Dawson Public Power
    c. Sherman County Sheriff
10) Body of personal experience in advanced composite design (see Section 9)
11) MIL-HDBK-17, Composite Materials Handbook

6. Visual Findings in the Primary Structure

The failure resulted in the molded assembly failing into three major sections. For consistency and uniformity of reference they are identified as follows:

- Failed Section 1 : Body Shell, see Figure 3
- Failed Section 2 : Attachment Structure, see Figure 4
- Failed Section 3 : Corner Segment, see Figure 5

The visual inspection of the failed structure indicates 3 prominent points of interest as shown in Figure 6. These points of interest are connected by a fracture network (yellow dashed lines) that traverse the assembly separating the structure into the three (3) sections noted above. For each point of interest a summary of visible indications are provided in the following figures.

Figure 3 Section 1, Bucket Body (with liner)

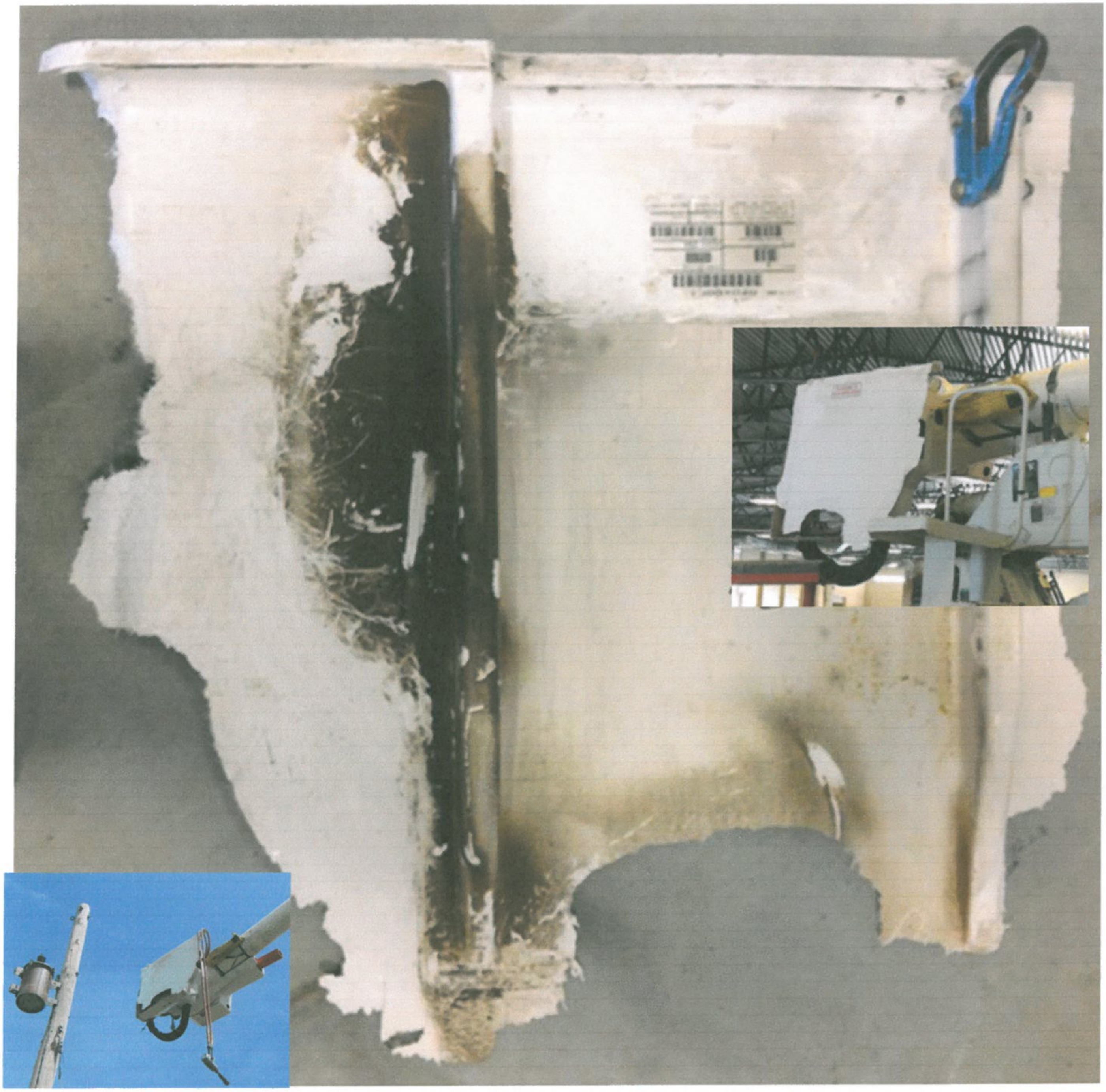

Figure 4 Section 2, Attachment Structure (View looking outward from boom)

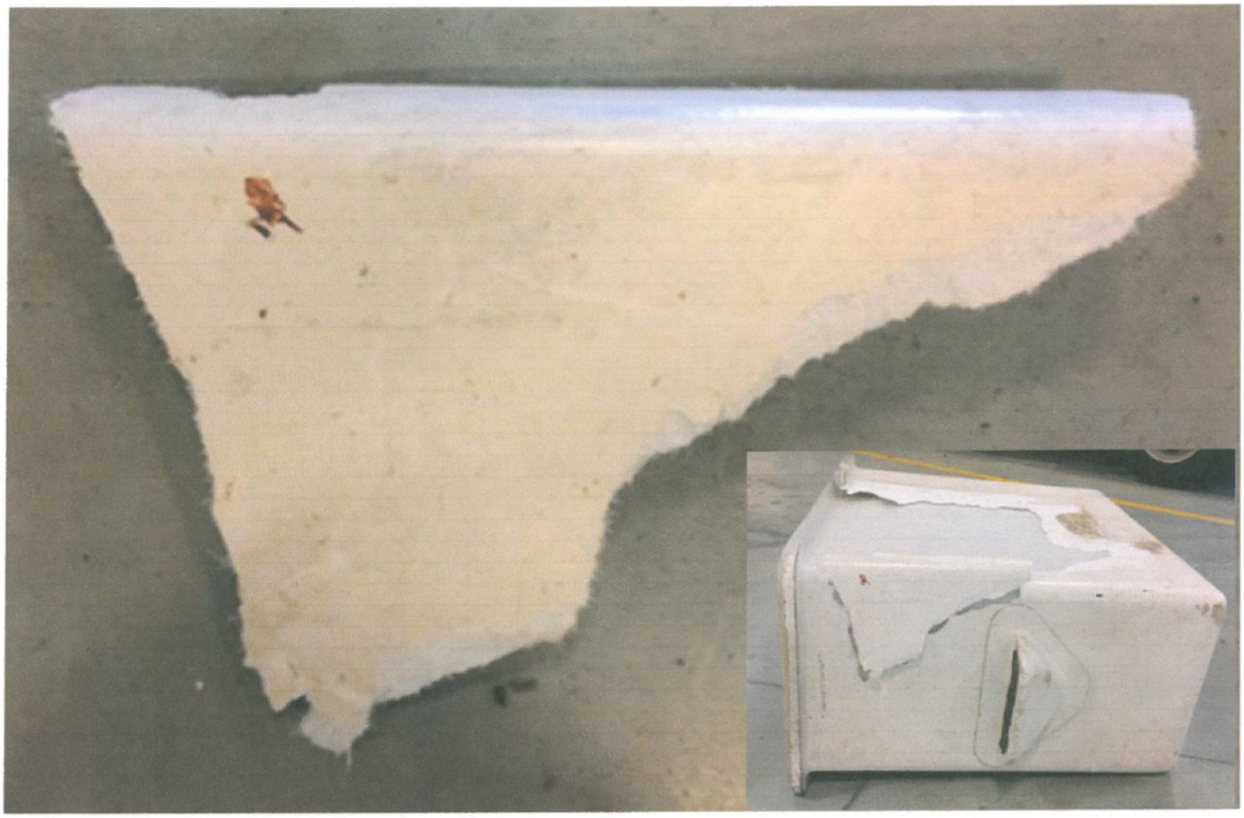

Figure 5 Section 3, Corner Segment

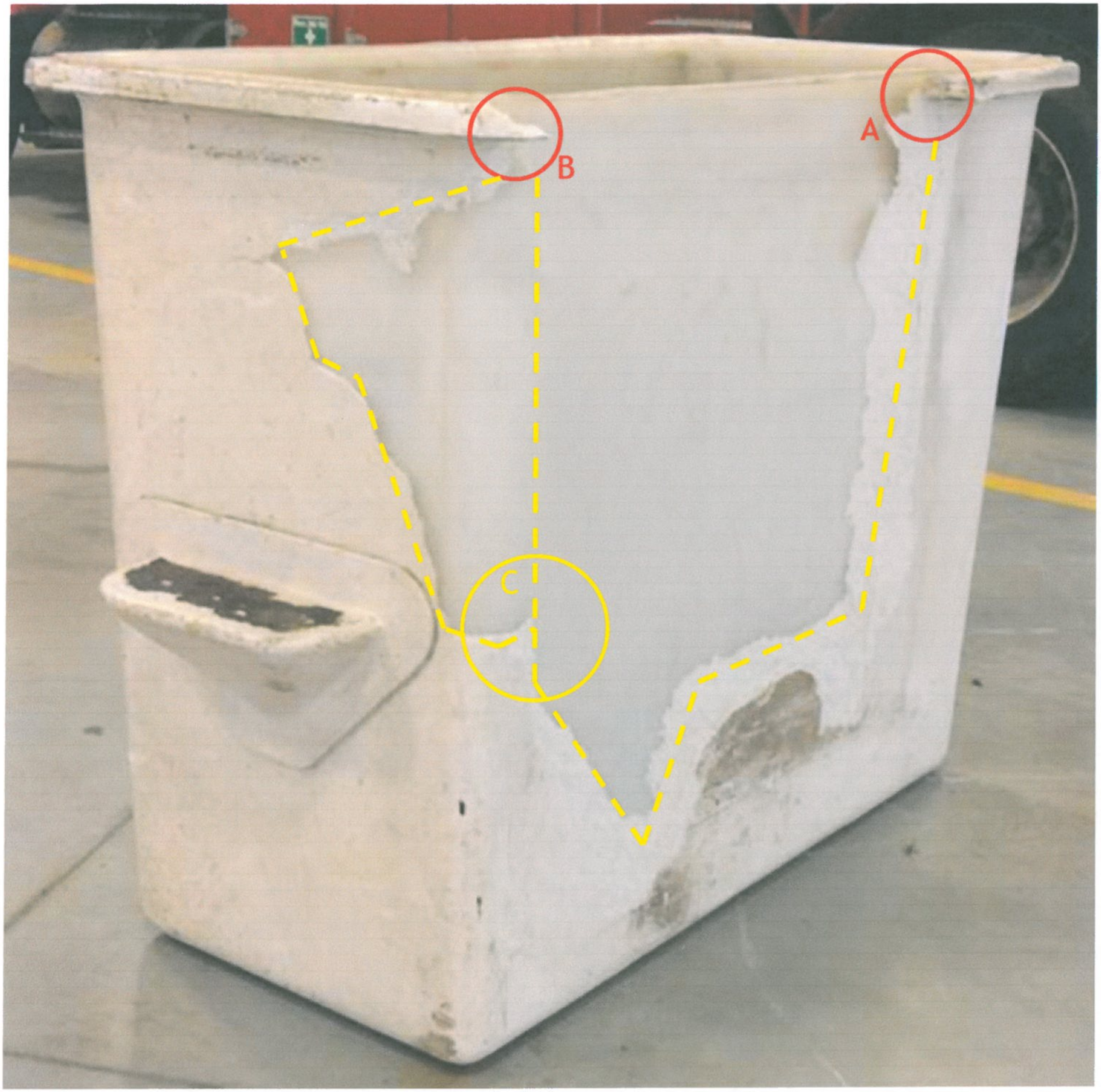

Figure 6 Locations of Interest

6.1. Summary of Visual Indications at Location A

The visual evidence at location "A" shows numerous composite ply delaminations that cut across the failure interface separating Sections 1 and 2. The common failure surfaces are clearly indicted in Figure 7 and Figure 9. There are several of these structural defects whose span reaches from the free edge of the flange to deep into the primary load carrying structure as shown in Figure 8. The exact locations and extent of many delaminations (structural defects) can be traced by the contamination that has collected between adjacent composite plies. This is positive evidence that the individual composite lamina were not bonded together in those locations. A likely source of the contamination (black color) would be migration of surface oils and dirt, which leeched into the laminate following and marking the extent of the unbonded surfaces. The yellow color on surfaces marking internal delaminations can be attributed to several factors such as oxidation of the resin from atmospheric exposure, migration of contaminants from the environment or evidence of under-catalyzed (improperly mixed) resin. But in all cases discoloration within the laminate bears witness to a pre-existing internal structural defect that prevented the individual laminate plies from contributing to the strength of the structure.

Figure 7 Location A, Section 1 (View looking right)

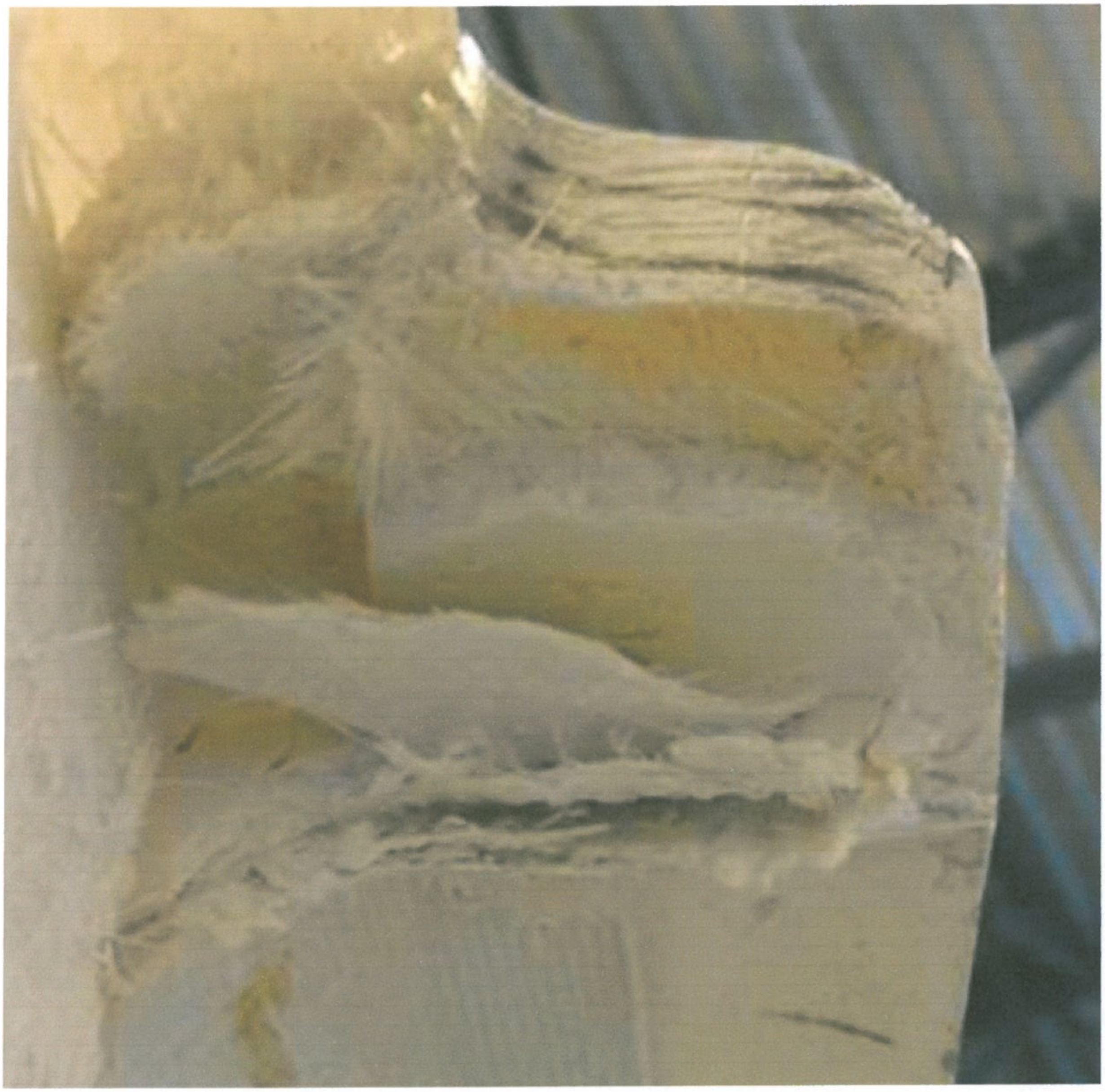

Figure 8 Location A, Section 1, (View looking up)

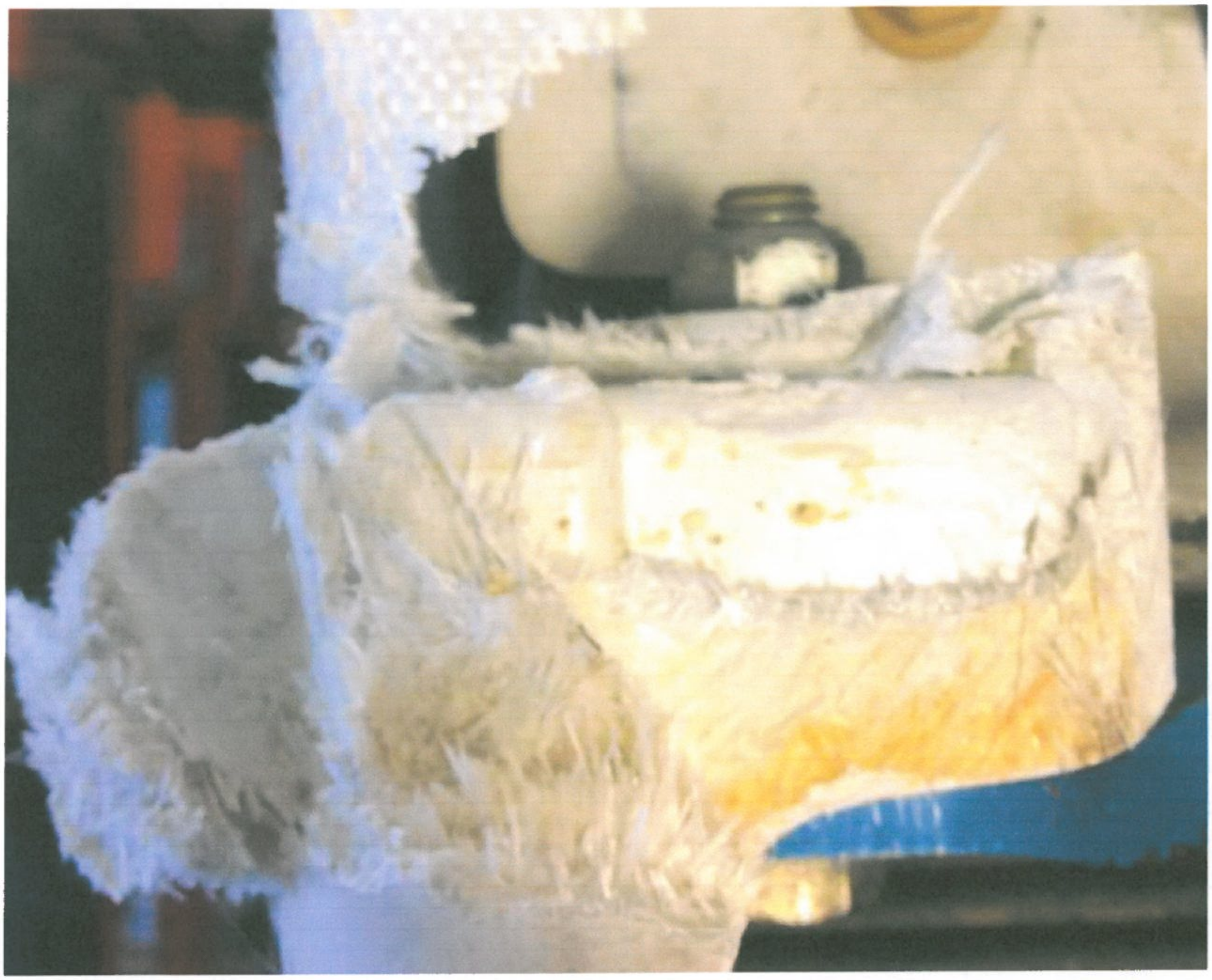

Figure 9 Location A, Section 2, (View looking down)

There are several exposed surfaces at location A on both sections 1 and 2, that by their clean and smooth texture show no positive indication of adhesion within the laminate from the time of manufacture. In several locations the delamination surfaces have no evidence of exposure to external contaminants, which is a strong indication that they were sealed into the assembly at the time of manufacture. Without full and complete disclosure of the exact lamination schedule and manufacturing process it is difficult to estimate the effect of each specific defect to the strength of the primary structure but it can be clearly stated that the ability of the structure to resolve loads through that location was significantly, if not severely compromised.

6.2. Summary of Visual Indications at Location B

The visual inspection at location B does not show the multitude of internal flaws that presented at location A. The laminate displays a uniform color and material composition within the laminate thickness as shown by Figure 10, Figure 11 and Figure 12. The failed sections at location B present surfaces typical of a composite laminate failing in a condition of overload with reinforcement fibers pulled out normal to the exposed surfaces. The exposed surfaces suggest a shear failure caused by an applied moment and tensile traction in the plane of the flange causing the separation of sections 1 and 2.

Figure 10 Location B, Section 1 (View looking right and forward)

Figure 11 Location B, Section 1 (View looking left)

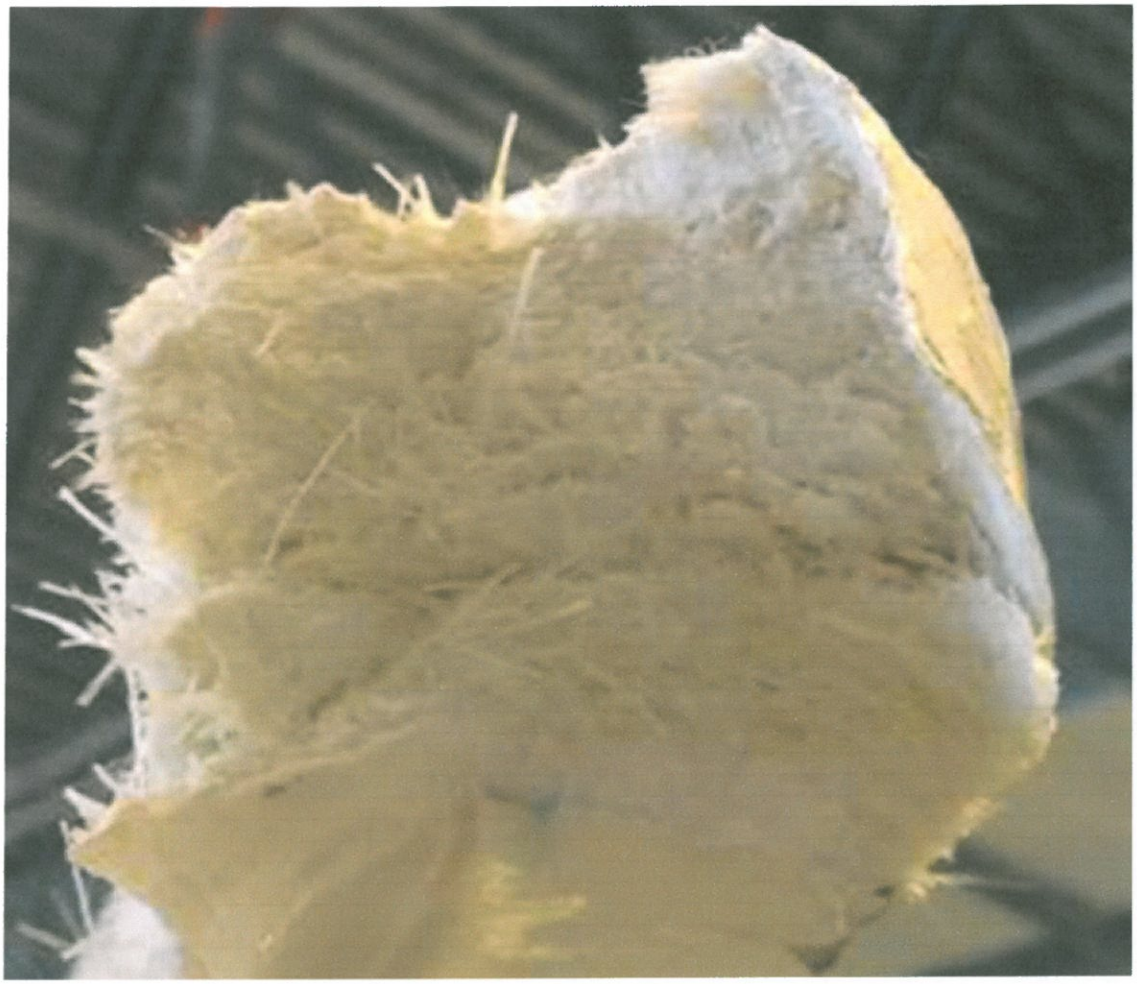

Figure 12 Location B, Section 2 (View looking inward and up)

6.3. Summary of Visual Indications at Location C

The visual inspection of the fractured surfaces at location C shows that the rate of energy dissipation was changing as the fracture crossed through location C (see Figure 13). The abrupt turn and separation into multiple paths along with a change of orientation of the separation plane within the laminate thickness indicate that the structure was likely shifting under the applied load and changing how the load was being transmitted between the bucket shell and the mounting point at the boom.

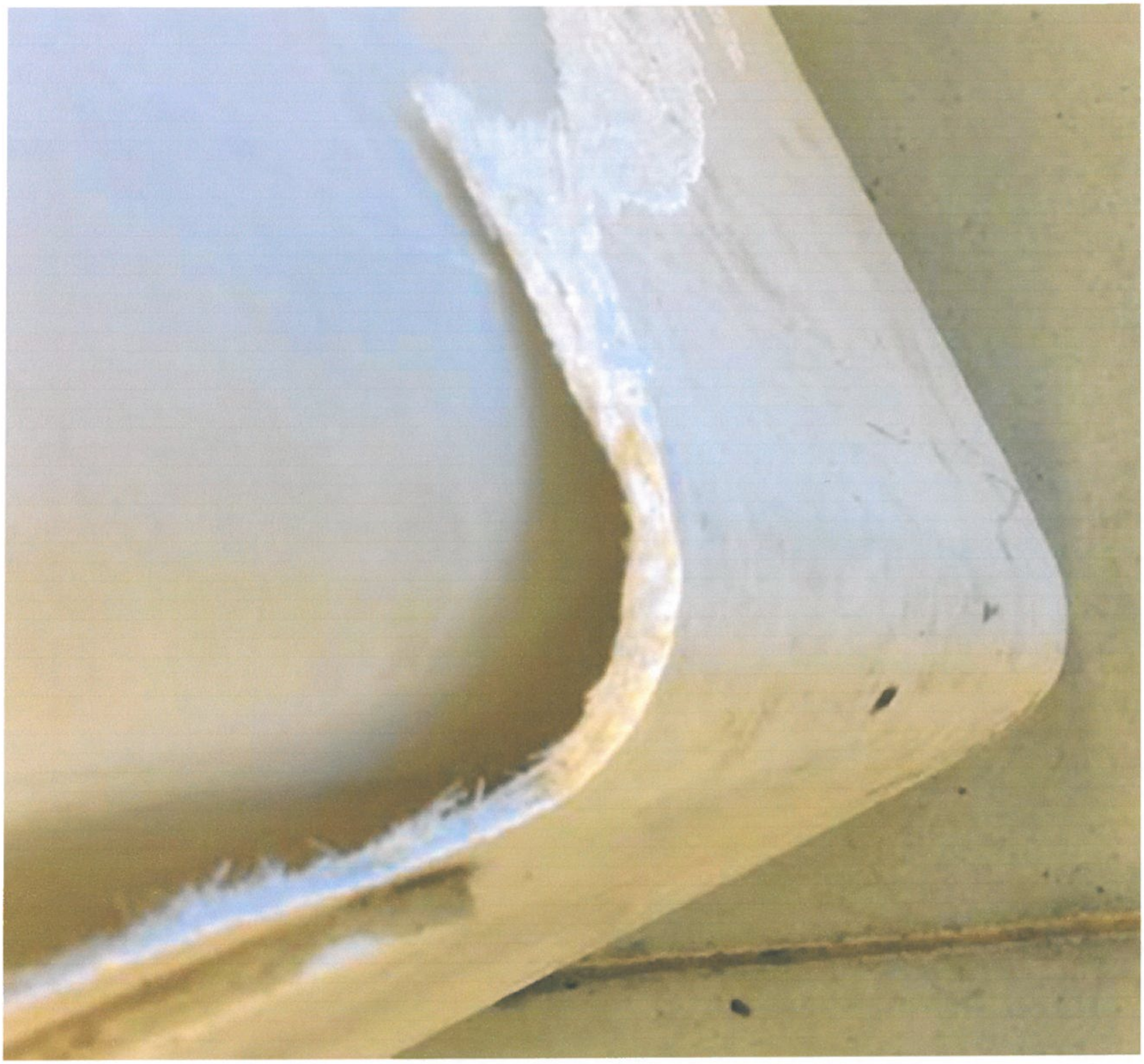

Figure 13 Location C, Section 1 (View looking downward)

7. Failure Event Narrative

Inspection of the photographs (see Figure 15) taken at the worksite indicates that it was highly likely that Mr. Keaschall was standing at the far outboard right edge of the bucket. This would have placed the maximum load (bending moment and tensile force) at location A. The top flange of the bucket assembly, which crosses over location A, provides a significant share of the stiffness holding the bucket orientation to the boom. Inspection of the failed sections 1 and 2 at location A also indicates that a mold insert (not disclosed by Altec) is keyed into the bucket flange at the time of manufacture similar to a tongue and groove connection (see Figure 16).

When the triggering load caused the numerous defects at location A to coalesce, the remaining structure was overloaded initiating the final failure sequence. The failure event likely started with a crack or muffled bang as the composite reached critical strength and started to fail. During the failure initiation the laminate in section 1 that engaged the raised lip of the mold insert of section 2, failed in shear (part of the coalescing of delaminations). In addition, the material in the flange adjacent to the raised feature of the mold insert failed. This resulted in tearing of the reinforcement in the bucket flange, allowing it to rotate over and become uncoupled from the mold insert inside mounting ribs in section 2 at location A (see Figure 16).

As the flange rolled over the top of the mold insert, the bucket started to peel away from the boom. A crack opening started to propagate down from location A. As this crack lengthened, a torsional moment was generated in the bucket flange as the bucket (section 1) started to peel away from the boom (section 2). This is witnessed at location C where the running fracture was briefly blunted by the added stiffness provided by the local curvature in the corner and the bucket flange resisted the developing moment. This resulted in a short pause in the failure sequence ranging anywhere from a heartbeat to a deep breath. As the propagating of the crack slowed coming into location C the composite flange at location B failed in torsion. This failure likely had an acoustic emission similar to the first one characterized as a louder crack or bang as it failed at a higher load than the composite at location A. When the flange composite at location B failed it separated sections 1 and 2, running fractures linked together parting the bucket assembly into sections 1, 2 and 3.

8. Commentary

The failure sequence indicates that separation of the bucket generally occurred from the flange downward. This would have resulted in a top-heavy center of mass for the load (Mr. Keaschall) on the far, right outboard corner of the bucket. This condition would have resulted in an arrested turning or rotation of the bucket as it rolled over responding to the top loaded center of gravity and the propagation of the fracture in the laminate. In effect Mr. Keaschall was dumped head first out of the bucket. The mechanics of the separation would have also imparted an angular momentum on the bucket as it fell free from the boom. This would have caused it to travel backward under the boom into the truck box resulting in the bent frame railing.

Also, providing for the nature of the defects recorded at location A, Mr. Keaschall would not have had any visual indication of the impending failure. The stiffness of the bucket under load would have been visually "normal" as the laminate would have retained its strength until a critical point was reached. The triggering event could have been as simple as strong upward heave (multiplying the load in the bucket) of a hand wrench to break a threaded connection.

A key comment on the general overall structure is that the primary composite reinforcement appears to be short fiber, chopped strand mat. This material even when properly applied is highly dependent on resin properties to resolve the applied load between the short fibers. This dependence on resin properties means the material even in the best conditions has very little ability to blunt or stop a propagating fracture. This can be demonstrated in the Altec testing for the bucket in as presented in Figure 14. This snap shot from Altec video DSCF5571.avi shows the creation and extension of a laminate flaw under load. This mechanism demonstrates how the laminate flaws grew, linking and coalescing together until the laminate reached its failure condition.

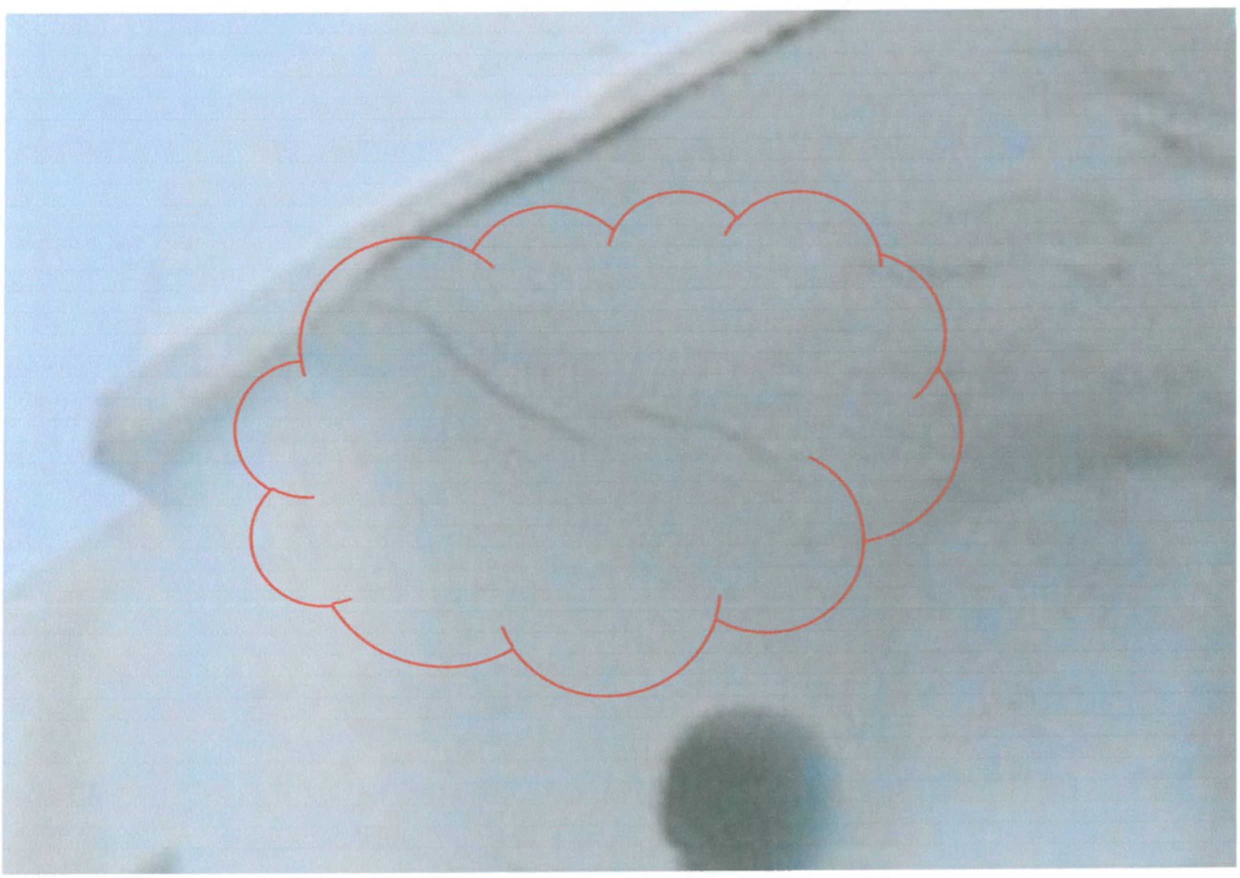

Figure 14 Location A, Crack formation and extension during testing.

This material selection coupled with a lack of redundant load paths in the bucket shell is atypical for a life critical structure. The simple inclusion of a relatively trivial amount of continuous fiber reinforcement in the bucket shell would have arrested the propagation of the fracture and given Mr. Keaschall the time to land the bucket safely even with the accumulation of failures at location A.

In this specific case the design did not demonstrate a "soft" failure mode that is typical for life-critical structures.

Figure 15 Orientation of Boom and Pole at Work Site

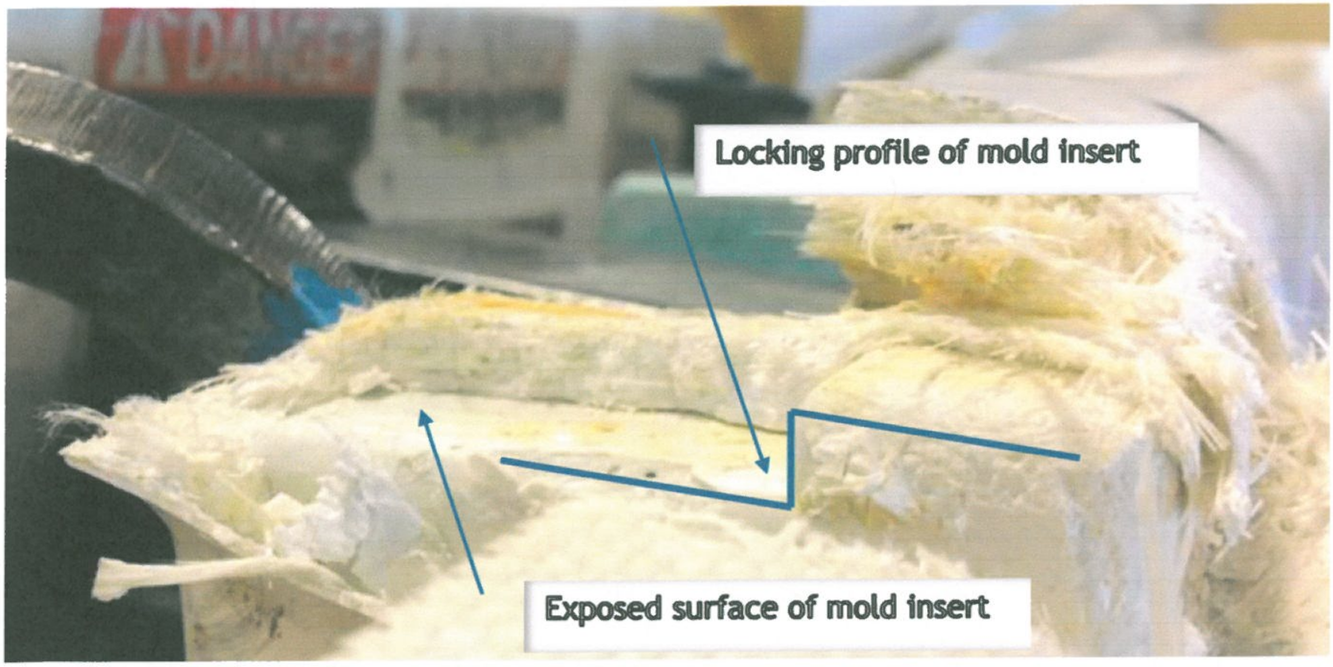

Figure 16 Location A Detail, Section 2 (View looking inboard)

9. Qualifications and Experience

Education

Dec 1998, University of Nebraska, Lincoln Nebraska, **MSME**

May 1981, University of Nebraska, Lincoln Nebraska, **BSME**

Professional Experience

1994-Present **Senior Design Engineer** – Hexagon Composites/General Dynamics/Lincoln Composites

Research and Development Engineer providing support for global normative and pre-normative standards development.

Technical Lead for the Hexagon Global Hydrogen Team providing leadership in product development and overall global market approach in the hydrogen fuel market

Senior Designer/Analyst for advanced composite structures for automotive and commercial applications.

Supervising engineer for very high performance pressure vessels in safety critical applications.

Program lead as a Tier 1 supplier to produce a gaseous fuel storage container, completing all requirements of the APQP (Advanced Product Quality Planning) process for a major automotive OEM (Original Equipment Manufacturer).

Responsible individual compiling detailed homologation reports for national and international regulatory compliance.

Lead system designer for vehicle fuel systems with expertise in the thermodynamic response of complex gaseous control systems.

Wide project experience from customer conflict resolution to vendor quality control.

Represents company on national policy issues with regard to pressure vessel and relief valve technology.

1991 – 1994 **Research and Development Engineer** – Coleman Powermate

Research and Development Engineer in support of generator and pressure washer product lines.

Supervised research and development of advanced electrical generators.

Developed new analytical design methods for validation of product performance

Performed extensive laboratory testing of prototype products.

1990 - 1991 **Senior Design Engineer** – Baldwin Filters

Responsible for product design and support for filters in both air and liquid automotive applications.

Developed new product specifications for new applications and development of test schedules for verification of performance.

Support of design to unit cost and manufacturing implementation of new products.

Provided service and technical support in response to customer issues.

1988 - 1990 **Program Manager** – Addax, Inc

Responsible for all program phases of funded research and product design efforts.

Programs included development of rocket motor cases, drive shafts, pressure vessels, and various advanced composite structural components for both the commercial and government markets.

1983 - 1988 **Design Engineer** – Brunswick Defense

Responsible for product design and stress analysis of advanced composite structures, including pressure vessels for aerospace and defense applications, tactical and ballistic rocket motor cases, finite element and closed form solutions for anisotropic and isotropic materials.

Served as principal design engineer for valves, plumbing, and electrical components on a 480 gallon fuel tank for the F-18 fighter aircraft.

Program experience included defining customer requirements and giving formal written and oral presentations.

1981 - 1983 **Design Engineer** – Phillips Petroleum Co.

Responsible for the design of all types of heat and fluid transfer equipment, using classical and computer analysis to predict performance.

Performed stress analysis for the design and repair of fired and unfired steel pressure vessels to ASME code.

Developed specifications and standards for high temperature and corrosive services.

Performed cost estimates for large chemical projects and design coordinator for a two-million dollar capital project.

Patents

Patent 5,180,490 : Lubricant Filter Assembly with Internal Bypass Lock-out

Patent 5,205,427 : Modular Fuel Tank System

Patent 5,529,460 : Pressure Washer with Flow Control Switch

Patent 5,848,604 : Thermally Responsive Pressure Relief System

Patent 6,986,490 : Method and apparatus for mounting a fluid containment cylinder

Patent 8,820,069 : Shape memory alloy trigger for pressure relief valve

Publications

Application of Plastic-Lined Composite Pressure Vessels For Hydrogen Storage, John A. Eihusen, General Dynamics, 15th World Hydrogen Energy Conference, June 2004, Yokohama, Japan

New Developments in Gaseous Fuel Storage for Heavy-Duty Vehicles by William E. Dick and John A. Eihusen, General Dynamics, Lincoln Operations, World NGV2002, Oct 2002, Washington, D.C. USA

Development and Certification of a CNG Fuel Tank for a Non-Step Bus, Tiller, Newhouse, Eihusen, Lincoln Composites, NGV2000 A-O15

Development of a CNG Fuel System for the ENVIRO 2000 TAXI, Tiller, Newhouse, Eihusen, Lincoln Composites, SAMPE Automotive, Sept 1999 Detroit, Michigan

Characterization of the Transverse Thermal Conductivity of Intraply Hybrid Composites Laminates, Eihusen and Peters, SAMPE Tech Conf, Oct 1999, 31T-07

Evolution of CNG Bus Fuel Systems, Tiller and Eihusen, Lincoln Composites, NGV'98 May 1998 Cologne Germany

Development of Compressed Natural Gas Storage Systems for Transit Bus Applications, Tiller and Eihusen, Lincoln Composites, APTA May 1997, Miami, Florida

Professional Activities

Registered Professional Engineer, State of Nebraska, E-6202

Full voting member of the Compressed Gas Association,

Cylinder Specification Committee

Associate member, Compressed Gas Association

Cylinder Valve Committee
TSA Security Guideline Task Group
Hydrogen Technology Committee

Full voting member of the CSA America,

NGV 6.1 CNG Vehicle Subsystems

HGV 3.1 / NGV 3.1 Technical Advisory Group on Development of Standards for Fuel System Components of Compressed Natural Gas and Hydrogen Powered Vehicles

PRD1 / HPRD 1 Pressure Relief Devices for Natural Gas Vehicles and Hydrogen Vehicle Fuel Containers TAG

HPIT 1 Technical Advisory Group on Compressed Hydrogen Powered Industrial Truck On-board Fuel Storage and Handling Components

NGV / HGV Series Technical Advisory Group, Common Issues Working Group

International Organization for Standardization (ISO), Technical Committee TC58 Gas Cylinders:

Subcommittee SC 3 Cylinder Design, US Representative and voting expert

ISO TC58/SC 3/WG 17, Compressed natural gas cylinders for road vehicles
ISO TC58/SC 3/WG 27, Composite cylinders
ISO TC58/SC 3/WG 32, Refillable composite reinforced tubes of water capacity between 150 liters and 3000 liters, design, construction, and testing

Subcommittee SC 4 Operational requirements for gas cylinders, US Representative and voting expert

ISO TC58/SC 4/WG 3, Methods for inspection and requalification of NGV fuel gas

containers

Awards

CSA America Divisional Medal award for leadership and commitment to the development of standards for hydrogen components, resulting in one of the first hydrogen component standards for pressure relief devices; a primary safety component for compressed hydrogen vehicle fueling systems that have unique fire safety and durability requirements

CSA America Corporate Award of Merit providing outstanding expertise to the PRD/HRPD1, NGV/HGV2, NGV/HGV 3.1 Technical Committees. Lincoln's Composites representatives have been extremely active and diligent members of the TCs, compiling and examining the texts of draft standards, and providing data to validate propose testing methods.

10. Previous Cases as an Expert Witness

None

11. Statement of Compensation

11.1. Travel Expense

Travel is billed in categories relating to distance:

Time between points within the city limits of Lincoln NE is not billed
For travel less than 60 miles from Lincoln, NE time is billed at actual time at a rate of $85/hour
For travel more than 60 miles from Lincoln, NE time is billed in 4 hour blocks at $85/hour

Mileage is billed at current IRS rate
Domestic airfare is billed at coach fare
International flight time greater than 9 hours is billed at Business fare

Expenses are billed actual plus 5%

11.2. Engineering Research and Analysis

The current rate for standard research and analysis is $325 per in hour, billable in 1/10 hour blocks

11.3. Third Party Services

Third party services contracted in behalf of the client charged at vendor invoice plus 15%. Vendor payment terms minus 10 business days apply unless other arrangements made.

11.4. Billing and Invoicing

Billing terms and conditions negotiated at time of engagement of services

12. Drawing Revision Data

Item Description	Doc No.	Doc. Rev.	Doc Title	Issue Date	Revision Description	Drawn By	ECO#	Comments
Bucket Assy	704-0065	A	PLATFORM, MOLD, RIBBED, 24 X 48 X 42	16Aug86	Initial Release??	JSK/RLD	??	Note 1, Resin not called out in BoM. Laminate Stacking Sequece not on drawing. Rib inserts (from failed part) not on drawing BoM.
Bucket Assy	704-0065	B	PLATFORM, MOLD, RIBBED, 24 X 48 X 42	26Aug92	1" WAS .75", ADDED .12" & 1.25" DIM, REDRAWN ON CAD	EJV	92-1033	Item 1 on Drawing 704-00350 BoM Item 1 on Drawing 704-00541 BoM (Weststar)
Bucket Assy	704-0065	C	PLATFORM, MOLD, RIBBED, 24 X 48 X 42	01Sep93	.250 WAS .188, 1.13 WAS 1.00, ADD VIEW A, R2.75 WAS R 3.00, ADD NOTE 3	TWW	93-1290	Made Walls and Bottom Thicker Made Flange Thicker Note 3: GELCOAT OUTSIDE FACES ONLY, INSIDE TO BE WHITE PIGMENT W/UV INHIBITORS.
Bucket Assy	704-0065	D	PLATFORM, MOLD, RIBBED, 24 X 48 X 42	06Oct93	R .38 IN SECTION A-A WAS 2X, ADD "RADIUS FINISH, NO SHARP EDGE"	SCH	93-1398	
Bucket Assy	704-0065	E	PLATFORM, MOLD, RIBBED, 24 X 48 X 42	19Nov93	DIM 21.50 WAS 21.12, 23.00 WAS 22.63, 1.69 WAS 1.50	Matt H.	93-1515	
Bucket Assy	**704-0065**	**F**	**PLATFORM, MOLD, RIBBED, 24 X 48 X 42**	**18Oct03**	**REDRAWN IN AUTOCAD**	**DLP**	**03-1073**	

Bucket Assy	704-0065	G	PLATFORM, MOLD, RIBBED, 24 X 48 X 42	29Sep06	REDRAWN IN SOLIDWORKS, MODEL WAS MODIFIED TO MEET THE PART PROVIDED BY SUPPLIER, DIMENSIONS OVER 20 INCHES WERE CONVERTED TO SINGLE DECIMAL PLACE DIMENSIONS (23.1 WAS 23.00, 21.3 WAS 21.50, 47.1 WAS 46.88, 45.5 WAS 45.44 & 41.3 WAS 41.25), PUT DRAFT NOTE ON RIBS TO COMPLY WITH SUPPLIER'S PROCESSES, SCUFF PAD SIZE NOT ALTERED, DISTANCE TO PLATFORM FRONT & BACK DID (1.59 WAS 1.69).	RLD	93-16913	
	704-00350		PLATFORM, FIBERGLASS, RETANGULAR, 46.00 IN L, 22.00 IN W, 41.00 IN H	03Aug93	Initial Release??	KAW		Note 1: GLUE ITEMS 2 & 3 TO PLATFORM & ALLOW 24 HOURS FOR CURE. Adhesive Not called out in BoM
	704-00350	A	PLATFORM, FIBERGLASS, RETANGULAR, 46.00 IN L, 22.00 IN W, 41.00 IN H	17Oct94	4.08 WAS 3.83	Matt H.	94-1091	

	704-00350	B	PLATFORM, FIBERGLASS, RETANGULAR, 46.00 IN L, 22.00 IN W, 41.00 IN H	03Jan01	ADDED DIM. 1.00	DIW	01-0503	
	704-00350	C	PLATFORM, FIBERGLASS, RETANGULAR, 46.00 IN L, 22.00 IN W, 41.00 IN H	22May02	ADDED NOTE 2.	JLL	02-0905	Note 2: PLATFORM CONSTRUCTION TO COMPLY WITH EN-241.
	704-00350	**D**	**PLATFORM, FIBERGLASS, RETANGULAR, 46.00 IN L, 22.00 IN W, 41.00 IN H**	**16Sep03**	**1.13 WAS 1.63.**	**JLL**	**03-0855**	**Increased depth of flange cut-out 0.50 inches** **Flange width is 1.13"**
	704-00350	E	PLATFORM, FIBERGLASS, RETANGULAR, 46.00 IN L, 22.00 IN W, 41.00 IN H	27Jun08	ITEM 2 P/N 970058583 WAS P/N 704-00043, ADDED NOTES "CENTER STEP ON SIDE OF PLATFORM" AND "STEP OPEN FOR ACCESS ON INSIDE"	TOI	093-20904	
	704-00350	F	PLATFORM, FIBERGLASS, RETANGULAR, 46.00 IN L, 22.00 IN W, 41.00 IN H	19Nov08	REVISED HOLE DRILLING ON RIGHT HAND RIB	J. Name	093-22124	
Component	704-10232		BOLT PLATE, CONTROL VALVE					Item 3 on Drawing 704-00350 BoM
Component	970058583		STEP, FIBERGLASS, 6 IN H, 12 IN W					Item 2 on Drawing 704-00350 BoM Item 2 on Drawing 704-00541 BoM (Weststar)

Comparison Final Assy (Weststar)	704-00541		PLATFORM, 24 X 48 X 41, SIDE MOUNT, A CLASS	4/8/97	Initial Release??	BPD	??	Weststar Drawing No instructions to install step. Cut-out Flange is 0.37" wider than drawing 704-00675 Flange width is 1.50"
Comparison Final Assy (Weststar)	704-00541	A	PLATFORM, 24 X 48 X 41, SIDE MOUNT, A CLASS	8/19/97	ADD MOUNTING HOLES AND LOCATING DIMENSIONS	RLD	97-1053	
Comparison Final Assy (Weststar)	704-00541	B	PLATFORM, 24 X 48 X 41, SIDE MOUNT, A CLASS	3/27/98	ADDED .91, .86 & .75 DIMS, (1.13) WAS 1.21	JSK	98-0687	Unable to locate 1.13" dimension
Comparison Final Assy (Weststar)	704-00541	C	PLATFORM, 24 X 48 X 41, SIDE MOUNT, A CLASS	11/17/01	REVISED TO SOLIDWORKS FROM AUTOCAD, ADDED (2) .56 DIA HOLES	HCW	01-1279	
Comparison Final Assy (Weststar)	704-00541	D	PLATFORM, 24 X 48 X 41, SIDE MOUNT, A CLASS	10/21/02	ADDED 2 X Ø .422	DLB	02-1374	
Comparison Final Assy (Weststar)	**704-00541**	**E**	**PLATFORM, 24 X 48 X 41, SIDE MOUNT, A CLASS**	**9/25/03**	**ADD ANOTHER SET OF LANYARD MOUNTING HOLES IN "RIGHT" RIB (SEE DETAIL)**	**RLD**	**03-858**	
Comparison Final Assy (Weststar)	704-00541	F	PLATFORM, 24 X 48 X 41, SIDE MOUNT, A CLASS	6/27/08	ITEM 2 P/N 970058583 WAS P/N 704-00043, ADDED NOTES CENTER STEP ON SIDE OF PLATFORM AND "STEP OPEN FOR ACCESS ON INSIDE."	TOI	093-20904	

MFG Spec	EN-241		FIBERGLASS PLATFORM CONSTRUCTION	5/22/86	Initial Release??			
MFG Spec	EN-241	A	FIBERGLASS PLATFORM CONSTRUCTION		?			No revision data
MFG Spec	EN-241	B	FIBERGLASS PLATFORM CONSTRUCTION		?			No revision data
MFG Spec	EN-241	C	FIBERGLASS PLATFORM CONSTRUCTION	12/13/96	Item 9, testing strength changed from 2000 to 1150-initial calculation was incorrect.	Mike Ande rson		
MFG Spec	EN-241	D	FIBERGLASS PLATFORM CONSTRUCTION	9/17/99	Added additional valve plates to cover all platforms being made in Item 11. Format changed to conform to current standard. See revision request #0482.	JS 09-21-99	#0482	
MFG Spec	EN-241	E	FIBERGLASS PLATFORM CONSTRUCTION	1/19/00	added option for additional construction methods approved by Engineering to 1.1. See revision request #0586.	JS 01-24-00	#0586	

MFG Spec	EN-241	F	FIBERGLASS PLATFORM CONSTRUCTION	3/9/00	Added platform performance testing. Added plywood thickness requirements to 2.2.1. Added hold time for the 12X test. See revision request #0599.	JS 05-03-00	#0599	

MFG Spec	EN-241	G	FIBERGLASS PLATFORM CONSTRUCTION	5/28/02	Added 2.12. See revision request # 1217	DM 06-03-02	#1217	
MFG Spec	EN-241	H	FIBERGLASS PLATFORM CONSTRUCTION	8/9/02	Added requirements for platforms with doors in section 2.12. See Revision request #1262.	DM 08-23-02	#1262	
MFG Spec	**EN-241**	**J**	**FIBERGLASS PLATFORM CONSTRUCTION**	**9/9/03**	**Added requirement for impact test in section 2.2.3. See revision request #1355**	**DM** **09-16-03**	**#1355**	
MFG Spec	EN-241	K	FIBERGLASS PLATFORM CONSTRUCTION	1/4/06	Added exemption for side push test on platforms with egress doors in section 2.2.1. See revision request #1657	DM 01-31-06	#1657	

MFG Spec	EN-241	L	FIBERGLASS PLATFORM CONSTRUCTION	6/27/07	Revised 2.10 to specify strap vice fixture. See revision request #2040.	SB 06-28-07	#2040	
MFG Spec	EN-241	M	FIBERGLASS PLATFORM CONSTRUCTION	10/26/09	Increased testing detail, added field testing requirements. See revision request #2663.	Ryan McKinney 10-26-09	#2663	

MFG Spec	EN-241	N	FIBERGLASS PLATFORM CONSTRUCTION	1/11/10	Added section 2.2.7. Section 2.3.4 150 lbs. was 60 lbs. See revision request #2763	Ryan McKinney 01-11-10	#2763	
MFG Spec	EN-241	P	FIBERGLASS PLATFORM CONSTRUCTION	1/28/14	Added part number for fastener, nut and washer to section 2.3.5. Added section 2.2.8. See revision request #2974	Ryan McKinney 01-28-14	#2974	

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEBRASKA

JULIE KEASCHALL, Personal Representative of the Estate of Kurtis Keaschall, deceased, and DAWSON PUBLIC POWER DISTRICT, Plaintiffs, vs. ALTEC INDUSTRIES, INC., and OSBORNE INDUSTRIES, INC., Defendants.	)	Case No. 4:14-CV-03070 DEPOSITION OF JOHN EIHUSEN, P.E. TAKEN ON BEHALF OF DEFENDANTS

Taken at the law offices of Johnson, Flodman, Guenzel & Widger, 1227 Lincoln Mall, Lincoln, Nebraska, on October 14, 2016, and November 29, 2016.

I N D E X

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A P P E A R A N C E S

For Plaintiff Keaschall:	MR. LARRY W. BEUCKE PARKER GROSSART BAHENSKY BEUCKE BOWMAN & SYMINGTON, LLC 1516 1st Avenue Kearney, NE 68848
For Plaintiff Dawson Public Power:	MR. STEVEN E. GUENZEL JOHNSON, FLODMAN, GUENZEL & WIDGER 1227 Lincoln Mall Lincoln, NE 68508
For Defendant Altec:	MR. ROBERT W. SHIVELY SHIVELY & LANNIN, PC, LLO 4400 South 86th Street Suite 100 Lincoln, NE 68526
For Defendant Osborne:	MR. STEPHEN L. AHL WOLFE, SNOWDEN, HURD, LUERS & AHL 1248 O Street Suite 800 Lincoln, NE 68508

S T I P U L A T I O N S

It is stipulated and agreed by and between the parties hereto:

1. That the deposition of John Eihusen, P.E. may be taken before Marcy Benge, RMR, General Notary Public, at the time and place set forth on the title page hereof.

2. That the deposition is taken pursuant to notice.

3. That the requirements of Neb. Ct. R. Disc. Section 6-330 (B) (A) and (C) are waived.

4. That the original deposition will be delivered to Mr. Stephen L. Ahl, Attorney for Defendant Osborne.

5. That all objections except as to form and foundation are reserved until time of trial.

6. That the testimony of the witness may be transcribed outside the presence of the witness.

7. That the signature of the witness to the transcribed copy of the deposition is not waived.

EXHIBIT B

(Exhibit No. 100 was marked for identification.)

(At 9:04 a.m. on October 14, 2016, with Mr. Larry Beucke appearing as counsel for Plaintiff Keaschall, Mr. Steven Guenzel appearing as counsel for Plaintiff Dawson Public Power, Mr. Robert Shively appearing as counsel for Defendant Altec and Mr. Stephen Ahl appearing as counsel for Defendant Osborne, the deposition commenced as follows:)

JOHN EIHUSEN, P.E.,
of lawful age, being first duly
cautioned and solemnly sworn as
hereinafter certified, was examined
and testified as follows:

(Witness's response to oath: "Yes, I do, ma'am.")

DIRECT EXAMINATION

BY MR. AHL:

Q. Would you state your full name for the record, please?
A. John A. Eihusen.
Q. Mr. Eihusen, my name is Steve Ahl, and we've just been introduced. I'm going to take your deposition this morning, asking you some questions about yourself and your background and about an investigation that you did involving a component that had been manufactured by Osborne Industries in part

of a boom lift system. Do you understand that?
A. Yes.
Q. Okay. And as we go along this morning, if I ask you a question that you don't understand for any reason, just seems awkward to you or doesn't make any sense, if you would just stop me and let me know that. I'll probably ask a bad question. I do it all the time. So if you'll stop me and let me know I've done it again, I'll be happy to ask it in a different fashion and make sure you understand it before you give me an answer. Will you do that?
A. Yes, sir. Thank you.
Q. Also, if as we're going along this morning you think an answer you've given me to a previous question is either inaccurate or incomplete, stop me and let me know that as well. I'll be happy to give you a chance to go back and either correct your answer or complete it, as the case may be. Will you do that as well?
A. Yes, sir. Thank you.
Q. Mm-hmm. And if you don't do any of those things, I'm going to assume you understood the question, you've answered it truthfully and to the best of your ability. And can I rely on that as we move forward this morning?

A. Yes, sir. That's the purpose of being here.
Q. Okay. That's what I think, too. So I just want to make sure we're on the same page. Would you state your business address for the record, please?
A. In this case the business address is my home address, 3310 Manassas.
Q. And what business is operated out of that location?
A. EiCon Services, which is my LLC for consulting services.
Q. That business, how long has it been in business?
A. I would have to actually look at the incorporation paper, but it's been, I believe, two years.
Q. Are there any other employees other than yourself?
A. No.
Q. Has that been true since its inception?
A. Yes, sir.
Q. And you run that business out of your home?
A. Yes, sir.

Q. What do the businesses -- business premises include? I suppose an office space?
A. Yes, sir.
Q. How about a laboratory?
A. No, sir.
Q. Do you have any scientific equipment there by which -- that you utilize to do testing or --
A. No, sir.
Q. -- experiments? Do you have that material available to you?
A. If required, it can be contracted.
Q. So you need to go out and rent it or secure it from somewhere else if you ultimately need it?
A. Right. Those services, yes, sir.
Q. And did you find that necessary in this case?
A. No, sir.
Q. What is your age?
A. Fifty-nine.
Q. And your date of birth?
A. 9/15/57.
Q. What is your occupation or profession?
A. Mechanical engineer.

Q. Can you give me your educational background that has qualified you to be a mechanical engineer? Starting -- let's start with high school.

A. Math and science sufficient to enter the University of Nebraska system.

Q. I'm assuming you graduated from high school, then?

A. Yes, sir.

Q. Where and when?

A. Minden High School, Minden, Nebraska, 1975.

Q. Okay. From there did you go straight to the University of Nebraska?

A. No.

Q. Where did you go?

A. I went to Florida Institute of Technology for two years.

Q. What type of a school is that?

A. It's a technology university. I went there for professional pilot training.

Q. Is it a university?

A. It is now.

Q. Was it when you went?

A. No. It was a -- it's grown in size. It's kind of like Kearney State grew in size and

became the University.

Q. Okay. How long did you attend that institution?

A. Two years.

Q. Did your attendance there result in the awarding of any degrees, diplomas or certificates?

A. No, sir. But all of the credits were transferable to UNL.

Q. Is that what you did?

A. Yes, sir.

Q. What year did you transfer to UNL?

A. '77. I'd have to look, sir. You're looking back at things I haven't thought about in a while.

Q. How long did you attend UNL?

A. I would have to look on the actual course list, but I was -- I believe it was, for the bachelor's degree, for about three years.

Q. And that would be in the engineering college?

A. Yes, sir.

Q. What year did you graduate?

A. 1979.

Q. Okay. What degree did you graduate with?

A. A B.S. in M.E.

Q. Pardon me?

A. A bachelor of science in mechanical engineering.

Q. What did you do next, if anything, as far as your formal education?

A. Continued to take classes and received my master's of science in mechanical engineering from UNL, and the exact date I would have to look up on my CV.

Q. And if we're not going by exact dates, but just your best recollection, what would you tell me?

A. There's no reason to go by recollection. We can -- it's published. We can look it up.

Q. But you don't have any idea as we sit here today?

A. Oh, that would be in the mid -- mid -- toward the end of the '80s and the early '90s.

Q. After graduating with your bachelor's degree, did you go to work somewhere?

A. Oh, yes, sir.

Q. Where'd you go to work?

A. Phillips Petroleum.

Q. Okay. Where were they located?

A. Sweeny, Texas.

Q. What did you do for them?

A. I was a mechanical engineer and assigned to special projects dealing with systems and materials and stress analysis.

Q. Okay. Why don't you just tell me what all that involves. I understand those are the general areas that you worked, but what did it involve?

A. I specified welding parameters. I specified heat exchangers, furnaces; provided engineering guidance on repair; provided engineering guidance on purchasing of additional parts and materials in that -- in that company.

Q. Did your degree in engineering, either your bachelor's or your master's, focus in any specific area?

A. No. I was split about equally between thermodynamics and structures.

Q. Are you a professional engineer?

A. Yes, I am.

Q. When did you get your designation?

A. I believe that was in 1982. I would have to look that up, sir.

Q. How long did you work for Phillips Petroleum?

A. As previously stated, approximately two years.
Q. How come you left?
A. It was in southern Texas, and we wanted to get closer to the Midwest.
Q. You say "we"?
A. My wife and I. I was married at the time.
Q. Is your wife employed outside the home at the present time?
A. Yes, she is.
Q. What does she do?
A. She is an administrator with Lincoln Public Schools.
Q. Upon leaving Phillips Petroleum's employment, what did you do next?
A. I went to Brunswick Composites.
Q. What did you do there?
A. At Brunswick Composites, it was -- we started to -- Brunswick Composites is in advanced materials and at that time was a company that worked in advanced composites and composites technology providing design and design services to the major contractors, defense contractors, at the time. We were able to get the last 2 to 3 percent performance

to make mission that no one else in the world could.
Q. Why did you leave Brunswick?
A. Brunswick, we really didn't leave. We were -- they went through several name changes. There was a -- a time when -- and I would have to go to the -- my resume or CV to get the exact dates, but I was offered a position in a start-up company here in Lincoln called Addax, A-d-d-a-x.
Q. Okay. What kind of a company was that?
A. That was another advanced materials, but it was a spin-off of Advanced Technology & Commercial Products.
Q. Who was the owner of that business?
A. The man was Jack Keester.
Q. When was this?
A. And Brian Spencer. I would have to look on my CV.
Q. Well, do you have it with you?
A. Yeah. It's on -- you have it. It's in what -- all the documents we...
Q. Do you have it?
A. 1988 to 1990.
Q. And why did you leave there?
A. It was a start-up company, and it was going through the throes of being sold. And the

owners were working those issues out. And I decided to take a position which was more financially stable for me and a young family.
Q. Where did you go?
A. I went to Baldwin Filters.
Q. Where are they located?
A. Kearney, Nebraska.
Q. What did you do for Baldwin Filters?
A. I was a filtration engineer and specified filter media and the design construction of filters across the general -- across the general product line.
Q. Was that their home company, in Kearney?
A. Baldwin Filters at the time had recently been sold to a much larger company called CLARCOR. So Baldwin Filters as a corporate location, likely, yes. I'm unsure about the answer, but they were owned by a larger company called CLARCOR.
Q. How long were you there?
A. I was there for two years.
Q. Why did you leave?
A. I was offered a position with Coleman Powermate, which was down the street, in an RV position to look at advanced power generation schemes.

Q. And what did that position involve? What did you do on a day-to-day basis?
A. They had a -- at that time they were -- they had acquired the rights to the Ballard fuel cell engine, which is Ballard Technologies, which is now owned, I think, by Ford. But they had acquired the rights for all of the Ballard fuel cell motors under -- I'm going to say five to seven horse, which would be in their product range for portable power.
Q. What did you do, though?
A. I was looking to -- they were looking to generate -- or build and construct a Stirling power generator.
Q. Okay. But what did you do?
A. I designed, built the prototype, tested it, worked with NASA, brought down as much as the technology could and tried to bring that -- that project to a conclusion.
Q. Were you the only engineer that was involved in the design, or were you designing a component or a portion of it?
A. I was over -- I had overall design responsibility for that project.
Q. How long did you stay there?
A. I was there for three years.

Q. Why'd you leave?

A. **Coleman Powermate was in the throes of being bought out by Sunbeam. And, again, it was a position of great instability that I saw coming. If you notice, Coleman Powermate is no longer in Kearney. I saw that. And so I called Lincoln -- in Lincoln, and the organization that I started with was extremely happy to have me back.**

Q. And who was that again?

A. **At that time that would have been one of the name evolutions of Brunswick Composites, Brunswick Defense, Lincoln Composites. It would have been all at the 27th and Superior location.**

Q. What did you do for them when you came back?

A. **Basically, exactly what I did when I left, only I came back as a senior design engineer responsible for building advanced composite parts.**

Q. For what? What -- what was the product ultimately?

A. **Lincoln Composites as a defense contractor has -- I worked on a lot of things that were on a need-to-know basis. I also carried a secret clearance at that time for a period of time. To give you some history, Lincoln Composites**

fabricated the second stage of the MX missile in Lincoln. They fabricated numerous launch tubes. The MLRS launch tube was designed -- designed, fabricated for a while in Lincoln, then shipped to Arkansas. The TOW launch tube, the VIPER program. There was a multitude of programs. Most of the satellite insertion motors, the primary structure is fabricated in Lincoln.

Most people are not aware that Lincoln, Nebraska, is a technology center for advanced composites. It goes right by them. There was a tremendous amount of technology at the time, and Brunswick had an excellent working relationship with a group of professors between -- at UNL. And between that institution of many names in that location, many, many advanced programs were able to proceed because we were able to reach the levels of performance that no one else in the world was able.

I will give you an example. Most of the pressure vessels in the space shuttles were designed and fabricated and validated here in Lincoln. And the age of those space -- of those pressure tanks on the shuttle was its actual true demise for its reaching out of service. Because the age and reliability was -- did not reach levels that would

continue in service, because they had been in service for over 25 years.

Q. How long did you stay there?

A. **I'm essentially still there. They were procured by General Dynamics. Then General Dynamics -- I was in a commercial division. General Dynamics spun that commercial division off to Hexagon Composites, which is still in Lincoln. And I am still working there as a principal engineer in standards and special projects, if you will.**

Q. What does your day-to-day job duties include there now? What do you do?

A. **I am responsible for numerous international committees in pressure vessels and pressure vessel safety and standards. I am currently working on a project that -- most of my projects are over 10,000 psi in structural and pressure containment.**

Q. Are you actually developing these projects or --

A. **Yes.**

Q. -- are you just overseeing them?

A. **I have a work scope to complete. A task to complete, build it, and I do.**

Q. You're actually out in the laboratory

working and doing the experiments and things of that nature? Testing?

A. **Oh, yes, sir.**

Q. Okay.

A. **I've looked at thousands of failed composite parts.**

Q. Who would be your immediate supervisor at the present time?

A. **Norm Newhouse.**

Q. What's Norm's title?

A. **He's VP of R&D engineering, I believe. I don't know what his exact title is.**

Q. When did you get into the consulting business?

A. **About two years ago I started the LLC to prepare myself to be thinking about end of career options.**

Q. Does your business advertise?

A. **No, sir.**

Q. How do you secure your -- your business?

A. **Word of mouth.**

Q. You don't put any ads in any publications?

A. **No, sir.**

Q. How many cases have you consulted on,

approximately?
A. **This is my first case, sir.**
Q. Do you have a fee schedule?
A. **Yes, sir. And you have it released.**
Q. I guess I'm just asking you, do you have it?
A. **Yeah.**
Q. Okay. What is your charges? Do you charge by the hour?
A. **I bill at -- my standard is $325 per hour billable in one-tenth-of-an-hour blocks. I charge $85 an hour for travel in four-hour blocks. Expenses are billed at actual cost plus 5 percent.**
Q. Is that true regardless of what you're doing as far as the $325 per hour charge, whether you're testifying, whether you're analyzing, whatever it might be?
A. **Yes, sir.**
Q. Okay. Do you have any sense of what you have charged in regard to your work on this case at this point?
A. **I have not billed my case out.**
Q. Do you have any idea what your charges are at the present time?
A. **I would have to go look through my hours**

to get a feel for that, but I'm estimating that we have probably over 100 hours into it.
Q. You didn't bring that material with you here today?
A. **No, sir.**
Q. Is there anything else that you didn't bring with you today other than your accounting records of your time spent on this case that you've either produced or have been given to you --
A. **No.**
Q. -- or relate to this case at all?
A. **Very specifically, the accounting records were not brought. That's the only thing I have. And those were not in the perceived scope of needing them.**
Q. They're what?
A. **It was not in my perceived scope that it needed to be brought.**
Q. You didn't think it related to this case?
A. **No.**
Q. Okay. But there's nothing else that you have that relates to this case in any fashion?
A. **To the best of my knowledge, this is -- everything here is what's on the table.**
Q. Okay. Nothing's been removed from any of

your files by anybody?
A. **No, sir. I've been in sole charge. That's the LLC.**
Q. Okay. Why don't you tell us what all you brought?
A. **I have a hard drive of my e-mails in PDF format. I have a list of references that I reviewed for the case, which are there. I also have a list of work product, and I believe on -- I'm not sure if that drive has the PDFs of the reports that were published. But that's on that drive.**
Q. Okay.
A. **On these paper copies, I have the paper copies of the reports returned to me from the other expert witnesses. I have pictures of -- that was taken -- pictures and loose documents of -- that were provided to me or what I took care of in California. I also have the original secrecy -- or the agreement for confidentiality treatment from the court. I have guidance of -- for federal witnesses. And I have my paper notes detailing the depositions and the documents that I reviewed going into -- that was part of the different disclosures released by Altec, the sheriff, and Osborne.**
Q. Okay. Anything else?

A. **To the best of my knowledge, that is all of it. But I did handle a great volume of data on the -- on the original look-through. This is the ones that I felt were important. There is a -- to the best of my knowledge, this is all of it.**
Q. Your last answer would lead me to believe that you've brought what you thought was important and not what you thought was not important. Is that what you're telling us?
A. **I brought what was unique in work product to me. Those common documents, I did not go through exhaustibly to bring them here as copies, because I thought they would be available to all parties already there.**
Q. Did you receive a copy of the notice of this deposition and -- telling you what you were supposed to bring today?
A. **I was verbally informed of what was required to bring, yes, sir.**
Q. And did you understand that you were to bring your entire file --
A. **I bring that --**
Q. -- and not bring what you thought was important?
A. **Yes, sir.**

Q. But you didn't do that?
A. Yes, sir. I did not bring copies of data already released to all the experts and already released to everyone else.
Q. Anything else you didn't bring?
A. No, sir.
Q. Besides your -- your accounting notes?
A. And my accounting notes, that's right, sir.
Q. Can you get that material and provide it to your attorney so that we can have it?
A. Oh, yes, sir. I'll just hand back the CDs that they handed me.
Q. Okay. If you'd do that, I'd appreciate that.
A. I can, sir.
Q. Anything else?
A. No, sir.
Q. Okay. As part of your investigation and analysis in this case, did you do any experiments or testing that you would have recorded any of the results, either written format or otherwise?
A. We would have -- in that category, we would have handled the x-rays, which would have been testing or invest- -- or review of the laminate.

Q. Let me ask you this: Did you independently yourself --
A. No, sir.
Q. Well, why don't you let me finish my question. Did you yourself independently do any testing, any experiments, or any analysis that -- where you would have recorded any calculations, test results or findings?
A. Can you break those questions -- I believe there were three questions there. Can you break them out? I answered, I believe, the first one.
Q. Okay. I guess I'm -- I'm not following you. Did you do any testing?
A. No, sir.
Q. Did you do any experiments?
A. No, sir.
Q. Did you do any sort of scientific analysis that you ultimately arrived at any -- that you did calculations on?
A. No, sir.
Q. Did you do any testing or experiments where you would have recorded the results of those?
A. No, sir.
Q. Do you remember when you were first

contacted about this case?
A. Yes.
Q. When?
A. I believe that would have been in -- I don't know the exact date, but that would have been in first quarter 2014. Or not -- excuse me. Third quarter of -- fourth quarter of 2014.
Q. Do you have any notes or anything that would indicate the date you were contacted?
A. That would be in my billing notes.
Q. Okay. And that's one of the things you didn't bring today?
A. Yes, sir.
Q. Who contacted you?
A. Mr. Guenzel has a -- we have a common friend, and he made the recommendation, word of mouth, that I might be helpful to this case.
Q. Okay. Who's that common friend?
A. His name is Bill Glaesemann.
Q. And how do you know Mr. Glaesemann? Do you work with him?
A. We used to work together. He's now retired.
Q. Okay. So Mr. Guenzel contacted you?
A. Yes.

Q. Did he call you?
A. Yes.
Q. At your home?
A. Yes.
Q. And when he first contacted you, what did he ask about?
A. He inquired of my experience. He inquired of my technical abilities and if I would be willing to look at photographs that were -- that I could -- and get an opinion on if I could look at some draw- -- photographs to get an opinion on.
Q. I assume that you agreed to do that?
A. Yes, sir.
Q. Were you given any information about the component that you were going to be looking at, why you'd be looking at it?
A. No. Just look at the component and proffer -- obviously, he told me -- he says, I have a composite part. It's failed. Can you tell me anything about it?
Q. Were you told the circumstances under which it failed or anything?
A. No, sir. At that time, that would have been under court order. That would have been information that probably would not have been

released to me. I was looking at documents -- or photographs that were not pinned to the court order and -- is my understanding.

Q. Okay. So you were just given some photographs, asked to look at them and see if you could come up with any opinions or conclusions about the failure mode?

A. **Right. And specific photographs would have been those produced by Coleman.**

Q. Were you provided any other information at that time?

A. **No, sir.**

Q. Were you asked to do anything else at that time?

A. **No, sir.**

Q. Were you provided the photographs?

A. **Yes, sir.**

Q. Do you remember specifically what photographs you were -- you were provided?

A. **The Coleman portfolio of photographs.**

Q. I'm assuming that you did that?

A. **Yes, sir.**

Q. And were you able to come up with any opinions or conclusions simply by looking at the photographs?

A. **Absolutely.**

Q. Did you ever look at the actual component itself at that time?

A. **No.**

Q. Okay. Just photographs?

A. **Just photographs.**

Q. Okay. And why don't you tell me what opinions or conclusions you were able to determine by looking at those photographs?

A. **Sticking in the photographic evidence at the time, I was able to immediately determine the location of the failure, the cause of the -- not cause, but the location of the failure, the failure mode, propagation of the failure through the rest of the structure, and come to a reasonable conclusion of how it failed.**

Q. You were able to do all of this just by looking at the photographs?

A. **Yes, sir.**

Q. How long did you spend looking at the photographs and formulating your opinions or conclusions at that time?

A. **The original -- the failure location and the failure mode at the primary location jumps out. There was a bit of time to justify the photographs in**

3-D space. Because that's what you do. You lay -- you build the part in your mind and -- at least I do. Build the part with the part in space in your mind, then eventually work around it and rotate it in your head and review it. And as I was able to lay it out, then we were able to piece -- I was able to piece that -- the entire narrative together.

Q. Did you ever do any computer modeling or anything of that fashion with the photographs?

A. **No.**

Q. Do you have the ability to do that at your home business?

A. **I have the ability to contract anything I need.**

Q. Okay. Do you have the ability to do that at your home?

A. **I have the ability. I do not have the equipment.**

Q. Okay. Again, that would be something you have to go out and hire somebody else to do?

A. **Either access to the machine or just buy the services.**

Q. Did you do it?

A. **It was not necessary.**

Q. Did you do it?

A. **No, sir.**

Q. After looking at the photographs and thinking about this, you arrived at some opinions and conclusions. I assume that you contacted Mr. Guenzel to tell him what those would be?

A. **Yes, I did.**

Q. And why don't you tell us now what opinions and conclusions you were able to draw simply by looking at the photographs.

A. **The part failed in shear on the primary flange, the horizontal flange that goes around the bucket. When it failed in shear and broke loose of its -- of the dovetail lock on the interlock, that flange separated and continued to load. As it continued to load, as -- as a composite continued to load, the fracture propagated away from the initial location, was hesitated briefly at a corner. At that point, the -- location "B" failed and a rotation was under load, as evidenced from the visual indications. And when that separated, the -- a fracture propagated from location "B" to what I call the hinge location in the corner. And the bucket separated.**

Q. Do you have any diagrams or photographs that would be indicative of what you're talking about? You're talking about location "A," location

"B" and a flange?
A. **Yes, I do.**
Q. Okay. Why don't we pull that out so we can attach this -- mark it as an exhibit and attach it so that we'll know what we're talking about when we read your transcript.
A. **That would be in Figure 2 of my report.**
MR. SHIVELY: Which report?
THE WITNESS: That would be on the first one. Or let me look. Actually, it's in -- that figure is used several times.
A. **I think the better one would be on the -- the first report published. And that would be** Figure 6, which is a larger picture of the same view.
Q. (By Mr. Ahl) Do you have that?
A. **Yes, I do. This is a much better version of that.**
MR. AHL: Okay. We'll just have her mark that.
(Exhibit No. 101 was marked for identification.)
Q. (By Mr. Ahl) Okay. Looking at Exhibit No. 101 now, I've asked you whether or not you have any diagrams or photographs that would show the various locations that you've just testified about

and have designated as locations "A," "B" and "C"?
A. **That's correct.**
Q. Does Exhibit No. 101 show those areas?
A. **Yes, sir.**
Q. Okay. And you have marked those areas and designated them as "A," "B" and "C"; is that correct?
A. **That is correct.**
Q. Okay. Now, why don't you go ahead again with this exhibit in front of you and tell us what opinion or conclusion or -- or plural, opinions and conclusions, that you were able to draw simply by looking at Mr. Coleman's photographs?
A. **On location "A," the top flange failed in shear by inspection of the -- of the -- of the failure surfaces. At that point, a running unsuppressed fracture propagated -- propagated on its way to "C." As it was propagating, that flange of the bucket pulled over the top and started to load in torsion. And it tried to resist the weight. And that weight was resisted at location "B." And at location "B," based on the angularity of that surface and how the composite was pulled apart, it indicated to me that that composite was under moment at the time of failure.**

And as it failed, the -- it then released the failure to continue from "B" on around to "C." And at "C," both failures met and -- at a horizontal position at "C," which I recognized since the fractured planes shifted again, and they changed orientation. The load hesitated there. And the fracture indicated again a bending mode instead of a propagating shear. And that indicated to me that that was a hinge location. And that was the last separation point from the bucket from the boom.
Q. Did you ever actually go down to inspect the bucket physically --
A. **Yes.**
Q. -- before arriving at this opinion?
A. **Yes.**
Q. Okay. When did you do that?
A. **The bucket arrived in Lincoln, and I was able to view it after your experts did.**
Q. Okay. I thought you were talking about your preliminary opinions and conclusions that you drew only on the basis of the photographs that were given to you by Mr. Guenzel?
A. **You gave me a -- you asked a question without a time.**
Q. Okay. Let's limit it to that.

A. **All right.**
Q. Let's talk about the photographs.
A. **In a timeline?**
Q. Yeah. When you came up with the first opinion that you've just expressed to us --
A. **That's correct.**
Q. -- you did that based solely on the photographs?
A. **Yes, sir.**
Q. Not by looking at the bucket?
A. **No.**
Q. Okay.
A. **I confirmed my opinion by looking at the bucket.**
Q. At some later time?
A. **Yes, sir.**
Q. Okay. Other than looking at the photograph which is designated as Exhibit 101, were there any other photographs that you relied on principally for formulating that opinion as to the failure mode?
A. **The -- there are numerous close-ups of location "A" and "B" on either side of the failure location, which I spent a great deal of time with.**
Q. Any other opinions or conclusions that

you expressed to Mr. Guenzel based on the photographic evidence that you first examined?

A. At what point in the timeline, sir?

Q. After -- when you first contacted him to tell him you've looked at the photographs, these are your opinions and conclusions.

A. I told him how I believed it failed and how the failure propagated through it. At that point, that's all the information I had.

Q. What was the next thing that you did?

A. The next thing was Mr. Guenzel requested my services officially. And at that point we started into a scope of work, generating a scope of work. And then a -- doing the necessary requirements to treat this information in a confidential manner.

Q. Did you ultimately arrive at what the scope of your work was to be?

A. Yes.

Q. Okay. What was that?

A. As provided in the first published report, I stated the scope of work as paragraph number 1.

Q. Okay. And that's page number 1, paragraph number 1, of your report dated September 26th of 2015?

A. Right. So what I -- what happened was, this was the scope of work generated by -- and provided to the attorneys that -- what was expected of me.

Q. After you formulated your scope of work that you were going to do in regard to this project, were you provided any additional information about how the -- how the incident occurred with Mr. Keaschall?

A. At that time, I was provided -- after -- after officially signing in and executing the proper confidentiality documents for the court, Mr. Guenzel gave me the balance of the information belonging to the case. Of which those being which I did not bring today.

Q. You didn't bring what Mr. Guenzel provided you to give you the background on this accident?

A. Yes. That was precisely those other -- those other documents. As in -- that was my justification for they're available to everybody.

Q. Yeah. But we don't know what he gave you, do we? I don't know what Mr. Guenzel gave you. Would I? Have you ever disclosed or -- or provided a list of what you've been given?

A. I have no -- I do not know how you -- the attorney communication. You're asking me to make an opinion on attorney communication. I can't do that.

Q. Okay.

A. I can only give you what I believed at the time.

Q. And you could have brought your entire file like you were asked to do?

A. Yes, sir.

Q. And you didn't?

A. Yes, sir.

Q. You know, Mr. Eihusen, this is going to be my only chance to visit with you and take your deposition and get your testimony and find out what you say and what you base all of your opinions on and what you've been told and the information that you had when you went into this analysis. And I guess I'd just as soon maybe reschedule this until you can bring us your entire file so I can see what you were told and what the basis of you going forward was with your investigation at the time.

A. If that's necessary.

Q. I think it is necessary. I'm going to ask you right now on the record to bring your entire file. Don't pick what you think is important. Don't

pick what you think everybody else has or doesn't have. You bring your entire file. Okay?

A. Yes, sir.

MR. AHL: Okay. And then let's just pick a new date, and we'll do this again.

MR. BEUCKE: Does page 6 there help you out?

MR. AHL: We're going to get his entire file there.

MR. BEUCKE: Does page 6 --

THE WITNESS: Yeah. It's -- the files were handled by you. So that's --

MR. BEUCKE: Can you tell him, referring to page 6 of your report, exactly the documents you did not bring?

THE WITNESS: Oh, let me look.

A. Well, the documents by Osborne are a lot. They're on a CD. Documents by Dawson Public Power, Sheriff Sherman County, additional depositions by the -- we may have those depositions by Public Power. But -- I did not bring Altec patents. But you have all of my -- you have my references and the MIL-HDBK-17. And the -- the photographic evidence from -- between Altec and Dawson and the Sherman Sheriff's Office is massive, but we can bring that.

Q. Okay. I'd just as soon you do that.
A. **Yes, sir.**
Q. And bring your billing records. And bring anything that has anything to do at all with this file since you were first contacted until the day we come -- we re-adjourn. Okay?
A. **No problem, sir.**
MR. AHL: Okay. Let's do it.
(Deposition adjourned at 9:49 a.m.)

(Exhibit No. 102 was marked for identification.)
(At 8:57 a.m. on November 29, 2016, with counsel for the parties present, the deposition recommenced as follows:)

DIRECT EXAMINATION (Cont'd)

BY MR. AHL:
Q. Still under oath from last time.
A. **Yes, sir.**
Q. Ready to go?
A. **I am, sir.**
Q. Okay. Last time we were here for your deposition, we were talking about the file materials that you generated since you first became engaged in this investigation.
A. **Yes.**
Q. Do you remember that? And we determined that last time you had not brought your complete file, but there were some things that you did not bring with you for whatever reason; correct?
A. **For -- and for clarity and for those -- what the incremental was, the documents that I -- that were under court seal was what I did not have. And my time log is the only thing that was missing from yesterday -- or the first time.**

Q. What do you mean under court seal? Do you mean under the protective order?
A. **Yes.**
Q. Okay. That was produced by Altec and Osborne?
A. **Yes. And those documents I treated like classified material. Do not duplicate. Do not disseminate.**
Q. Okay.
A. **And so I was a bit surprised to see that -- to do both. But they are now incrementally, and the time sheet -- time logs are in. Those two incremental increases are now in that sum total.**
Q. Okay. And that now -- you've provided us with a thumb drive this morning, which has been marked as Exhibit 102, is it? That now contains your entire file with nothing removed?
A. **That is, sir.**
Q. And let me show you the blue thumb drive that I've been provided by Mr. Guenzel and ask you if you can identify that as being the one that you brought here today that contains your entire file in regard to your work on this matter?
A. **No. This is a copy that Mr. Guenzel made.**

Q. Have you seen it?
A. **Have I seen this?**
Q. The copy?
A. **I had heard that he duplicated it.**
Q. Okay. But the materials that you gave him to duplicate contained every document that you have either been provided, generated or otherwise --
A. **Yes.**
Q. -- during the entire investigation?
A. **Yes, sir.**
Q. And you've removed nothing?
A. **Yes, sir.**
Q. Okay.
MR. GUENZEL: And I will state for the record that the Exhibit 102 has -- is an exact copy of the thumb drive he brought me that he just described for you.
MR. AHL: Okay. Fair enough.
Q. (By Mr. Ahl) Okay. We were just getting into some of the context of when you were first retained in regard to this --
A. **Yes, sir.**
Q. -- investigation last time when we stopped. Do you remember that?
A. **I'll let you -- I'll let you jog my**

memory.
Q. Okay. Well, I think we were talking about when you were first contacted and by whom and what your discussions may have been. Does that jog your memory?
A. **Yes.**
Q. Okay. Do you remember when you were first contacted?
A. **Yes.**
Q. And can you tell me that?
A. **The -- Steve Guenzel gave me a call and asked me if I would review some -- a set of doc- -- of pictures. And if I had a -- could evaluate how that -- that part failed. And he said he was having difficulty finding suitable experts in the country that could do that job.**
Q. Okay. Do you remember when that conversation took place?
A. **It was in my time log.**
Q. Okay.
A. **But it's logged. It's 5/15 or 5/16, over a year ago.**
Q. Okay. At that point in time you were provided with photographs?
A. **Yes. That would be considered the**

Coleman portfolio.
Q. Okay. Were you provided anything else?
A. **No.**
Q. When you were first retained, you indicated that you could do what the scope of work Mr. Guenzel was looking for, I assume?
A. **Well, the first question is, is did I know how it failed.**
Q. Well, but -- but did you tell him you were a suitable expert to look at that?
A. **Yes.**
Q. Okay. And the first question that you were asked to determine is, can you determine why or how it failed?
A. **Yes. Or the manner in which it failed, specifically.**
Q. And by virtue of you being retained, I'm assuming that your answer to that was, yes, you thought you could?
A. **Yes.**
Q. When you were provided with the photographs, were you provided any other information to help you in your analysis of why or how this bucket may have failed?
A. **Yes. Later.**

Q. Okay. Why don't we go through, and why don't you tell me those things that you were provided by outside sources that you used in formulating your opinions or your conclusions.
A. **The -- first of all, we looked at the entire body of the Coleman photos.**
Q. Okay.
A. **And resolving those into a 3-D space in my mind, looking through the fracture planes and surfaces, and the evidence in the composite was extremely compelling to me on how it failed and the order it failed. After we were signed in, after I executed the court order, I was then handed the rest of the documents and disclosures, excluding any medical. Which I specifically asked not to have issued to me.**
Q. Okay.
A. **So I had all of the depositions at that point. I also did a bit of research on a little bit of the Altec patents, what they were looking for, and I also did a site review of a truck. And I went onto and looked at a truck. And we also did x-ray and performed some other minor NDE techniques. But the biggest one was being -- looking at the x-rays of the -- of the buckets themselves.**

Q. Okay. And when did you do that?
A. **Again, I would have to go look at my logs for an exact date.**
Q. Okay. Can you give me just kind of a general timeframe?
A. **Middle of -- middle of last year. It was in the summertime, I think. That would have been -- well, wait a minute. I can get very close.**
Q. Okay.
A. **It would have been the date of my appendix report. So it would have been just prior to March 3rd, 2016.**
Q. Okay. In your consulting work, and in particular in your consulting work on this particular case, do you have a lab available to you?
A. **You can contract labs from anywhere in the world if you have -- if you know what you're asking for.**
Q. Okay. Absent going out and hiring someone to do something or contracting with a lab to use their equipment, do you as a consultant have a lab available as part of your consulting business?
A. **No.**
Q. Okay. And, again, let's exclude going out and renting, hiring or leasing something. Do you

have any equipment available to you in your consulting business that you use or did use in your analysis of this case?

A. **No.**

Q. Have you consulted with other individuals who have provided you information in regard to your investigation in this case that you have used that information in formulating any opinions, conclusions or impressions?

A. **No. My con- -- my opinions were formulated fairly rapidly on the initial investigation of the composite. And they have -- what the evidence that the composite itself showed. And that was the basis of my review, was looking at the composite.**

Q. Was that looking at the photographs, or was that looking at the actual bucket itself?

A. **Both.**

Q. Okay.

A. **And the trucks that they were mounted on.**

Q. So you have not retained or hired any other consultants that have performed any analysis for you of any type where you've used that information in formulating or supporting any of your conclusions, impressions or opinions?

A. **That was -- if you check my e-mails, that was contemplated to do. We were -- my rec- -- initial recommendation was to do a credible FEA. And when I say credible, something that was -- that measured design intent. And that was the looking at the start of the second bucket, to find. When I realized that the second bucket was not built in the same fashion, there was no way I could or anyone could do a credible FEA. And so there was really no need to move further in any analysis.**

Q. So your answer is, no, you've not hired or contracted with anybody to perform any type of analytical services that have provided you with information that you've used in your opinions, conclusions or impressions?

A. **That's true.**

Q. Okay. Have you had anyone do any type of analysis for you of any of the composites or any of the equipment used or involved in this incident?

A. **We shared laboratory work with your experts. I consider that part of that effort, yes.**

Q. Okay. Other than the experts who have been retained in working on this, anybody that you've used independently?

A. **Well, we would have done our own, but**

since we shared the experts, we decided to share the work there. So, yes, that's -- you have full access. We -- that was the idea of the shared laboratory. There was no reason to go further.

Q. Okay. So, again, your answer is, no, you haven't?

A. **In the same manner of your people, yes.**

Q. When you were provided with the Coleman photographs, you did a review of those photographs. Was that done just basically with the naked eye, or did you use any type of microscopic examination of the photographs?

A. **The photographs are very good. And you can digitally work on. But the question is, when you look at those photographs, you're -- you're looking at telltale signs that's taken years and years of working in the composites field to see what's going on. And, like I said, the evidence was quite compelling to me in the composite structure itself, how it failed.**

Q. I understand your answer, but that doesn't answer the question I asked. Did you look at it with your naked eye, or did you --

A. **I looked at it with my naked eye, sir.**

Q. That was the only way?

A. **Yes.**

Q. Okay.

A. **Quite adequate.**

Q. Okay. After looking at -- when did you look at those Coleman photographs? Was it, like, in the spring of 2015?

A. **It would have been probably -- the first report is dated September 26th. So it would have been spring, summer, yeah, somewhere in there, of '15.**

Q. And you do have the Coleman photographs with you?

A. **I have them on that jump drive, sir.**

Q. Okay. Do you have just regular copies with you --

A. **No.**

Q. -- by any chance?

A. **No.**

Q. In looking through some of the material that you provided to us last time we were here for your deposition, there was a series of e-mails contained in those materials. And in one you're talking about your review of the Coleman photographs. And that's in an e-mail dated May 12th of 2015.

A. **Okay.**

Q. Let me have the court reporter mark that, and I'll show it to you.
A. May I see it?
Q. Absolutely. After we get it identified.
(Exhibit No. 103 was marked for identification.)
Q. (By Mr. Ahl) Okay. Let me show you now what the court reporter has marked as Exhibit 103, and let's make sure that's an e-mail from you. Is it?
A. Yes.
Q. Okay. And does that appear to be a true and accurate copy of the e-mail -- an e-mail that you would have generated on or about the date reflected on the exhibit?
A. Yes.
Q. Okay. And you're talking about the review of the photographs?
A. Yes.
Q. Okay. And in there you indicate specifically that you found a very large manufacturing flaw in the photographs?
A. Yes.
Q. And that's a game changer, in your -- your opinion?

A. Yes.
Q. Okay. Do we have those photographs?
A. You have the x-ray. This would be the x-rays.
Q. So this -- these are not the photographs?
A. Those are the x-rays.
Q. Okay. Do we have those?
A. Yes.
Q. Here today?
A. Yes.
Q. Can you find those for me?
A. They're in the jump drive.
Q. Okay. If we have --
A. But they're in the -- we do have copies in my report.
Q. Okay. Why don't we get that, those photographs, out in your report.
MR. BEUCKE: May I see it?
MR. AHL: Sure.
A. This is the rib that did not fail. Do you want this?
Q. (By Mr. Ahl) Yeah, I do want that. I'm going to ask you about it. You've just handed me what is identified as page 7 out of one of your reports; is that correct?

A. That's correct.
Q. And that's what you indicate that you're referring to when you're talking about photographs in Exhibit No. 103?
A. Yes.
MR. AHL: I'll mark that.
MR. GUENZEL: If I could interject, Mr. Eihusen, if you'd take a look at -- he's asking you about Exhibit 103, which is an e-mail dated May of 2015. I thought you told us --
MR. AHL: Well, you know, I don't want you to testify. If he's got his dates inaccurate, he can figure it out.
MR. GUENZEL: Well, he's been -- he's gotten -- he's jumped off. And if you want a bunch of inaccurate information, you can keep going. You're asking about an exhibit -- you're going off of Exhibit 103, and I think he ought to take another look at Exhibit 103, because he's jumped about six or eight months.
MR. AHL: I think he has, too, but -- because I don't think these existed back then.
MR. GUENZEL: I don't think they did either.
MR. AHL: So I don't know what he's

talking about, and maybe he can explain that to us.
MR. GUENZEL: I hope so.
MR. AHL: I hope so, too.
Q. (By Mr. Ahl) Let's mark this first, because this is what you identified.
(Exhibit No. 104 was marked for identification.)
A. Yes.
Q. (By Mr. Ahl) Let me hand you what has been marked as Exhibit No. 104. Now, that's what you handed me --
A. Yes.
Q. -- as referenced as the photograph referenced in Exhibit No. 103 --
A. Yes.
Q. -- in your e-mail?
A. Right. And the -- let me clear, is this shows up as deep, dark lines in the -- in the pictures, in the Coleman pictures. And those deep, dark lines are flaws in or indicating a deep delamination. That's what this was. My tying them together is, this picture is so much more indicative of what we were seeing here. So my apologies on mixing this up. But these deep, dark, straight striations on the edge, to a trained eye, indicates a

laminate in trouble. So what we were looking at here was this picture removed from the other side from the failure. So we had a clear picture now of what we were looking for and how this thing was -- was reacting in service.

Q. Okay.

A. **So my -- my apologies. I was -- it's the same defect. It's how it's looked at. And this one is much more educational on where it is and how it is.**

Q. Well, Exhibit No. 4 is now what you're referring to in Exhibit No. 3; correct?

MR. GUENZEL: Do you mean 104 and 103?

MR. AHL: Yeah. I thought that's what I just said.

A. **And you can see these in the Coleman pictures when you look on edge, and you can see the black -- deep, black layering, which indicates a delamination on that on the far side. And this is --**

Q. (By Mr. Ahl) But when you wrote this e-mail, the images in Exhibit 104 didn't exist, did they?

A. **That's correct.**

Q. So that's not what you were referring to in terms of the actual photograph?

A. **Yeah. In my mind, it was the same defect, sir. This one is much more indication -- I did not believe it to be as large and as extensive as the x-ray proved to be. Because when you're looking at it here, you can see that you have a staining. You can see the edge on effect of the opening of a -- of the laminate. But you can't evaluate it. You just know it's there. And so these are much more instructive to me, and so that's why they locked in my head.**

Q. Okay. Can we find the photograph that you were actually referring to?

A. **Sure. If we have a copy of the Coleman, I'm sure we can find -- it shows up on multiples. I just didn't pick up on it.**

Q. What I'd like to have is the actual photograph that you were looking at when you claimed you found a game changer and that you found the manufacturing defect. That's what I'd like to see.

A. **Let's see if we can get something that's close. I just don't have a close-up on that other side. We'd be looking on the other side. We'd be looking for that dark, staining line. And I do not have a view of it. But those -- that's an indication of a -- the laminate was in trouble. And that's on**

the failure location. And we could see that it was reaching back. What I didn't catch up was, it was existing on the other side, which means it was going all the way across. So it's on the Coleman view. We can provide that.

Q. Maybe when we take a break, you can take a look on a computer and see if you can find the actual photograph. How does that sound?

A. **I think we can do that, sir.**

Q. Okay. Great.

A. **I don't think it would take very long at all.**

Q. Okay. And, specifically, what manufacturing defect are you talking about? What is it?

A. **We have a -- the defect is, it -- uncompensated resin shrinkage tends to, on a fixed mold, a mold that is fixed on both sides, the resin will pull apart and cause a -- when it shrinks will cause a gap or opening. And that defect typically finds itself as laminar indications on the midplane or near the midplanes, depending on how much resin shrinkage was there and how uncompensated it was.**

Q. That's the manufacturing defect that you saw on the photograph that you looked at?

A. **Yes. In fact, that was one of the potential causes that I listed in my first report.**

Q. What is the result of that defect, in your opinion?

A. **Well, one has to approach the defect in terms of design intent. What was the intent. I have not seen anything here on any disclosures, anybody's analysis, that speaks to the design intent. And that means, how did the designer who put this together, how did he design -- intend for it to function. Without that, it's pretty hard.**

But I'll give you my best understanding of design intent, is this preformed piece that was set in the rib has a locking dovetail that reaches up and locks into the edge of the bucket, the bucket flange. And that was provided a lot. When you have a defect that reduces a shear area on that location, that becomes a very significant manufacturing flaw.

Q. I guess what I'm really asking you is, what's the effect of the flaw, in your opinion? Is it -- does it weaken the material? Does it -- what's the result of that flaw, in your opinion?

A. **That flaw would probably pass proof load. It might pass DVT load. The question is, is it cycling. How many cycles can it take. How long will**

it go in service. It will progressively -- what happens is, these -- a flaw like that will progress, reducing the allowable shear area or the load capability of the joint until it fails.

Q. Did you ever do any testing to determine if, in fact, that area was weakened by this defect? Did you do any testing?

A. **No.**

Q. Did you do any testing at all to determine what, if any, effect the defect that you are claiming you see had on the design of this bucket? Did you do any testing?

A. **No.**

Q. Did you ever visit the Osborne plant to observe the manufacturing process?

A. **No.**

Q. You indicate that as part of your investigation, you also had the opportunity to see a truck and a boom?

A. **Mm-hmm.**

Q. Yes?

A. **Yes.**

Q. Was that the truck and boom involved in this incident?

A. **It was a near identical one. I was**

advised from Dawson that it was identical to the one that had been in service.

Q. Why didn't you look at the one that was in service there?

A. **I believe it had been disposed of. I'm not sure.**

Q. Okay.

A. **It was not available to me.**

Q. Okay. Would you have liked to have seen the actual one?

A. **Not really.**

Q. Okay. Didn't make any difference to you?

A. **Well, if they're manufactured the same. I wanted to see use.**

Q. It didn't make any difference to you?

A. **Evidence was in the composite.**

Q. Again, I --

A. **That's correct. It did not make any difference.**

Q. Okay. You've prepared two reports detailing your investigation and your analysis in this case; is that correct?

A. **That's correct.**

Q. Have you got those in front of you?

A. **Yes, I do. Except for one page marked**

Exhibit 104.

Q. Okay. Let's take a look at your first report that's dated September 26th of 2015.

A. **Okay. Do you have a page?**

Q. Yeah. Why don't we just go right to page 1, jump right into it. How does that sound?

A. **Okay.**

Q. On page 1 you indicate under a bullet point, "Scope of Work for Expert Analysis," and then you list five separate questions that I assume that you are going to attempt to answer throughout your -- your investigation; is that correct?

A. **That's correct, sir.**

Q. And then, if I'm reading your report correctly, on page number 3, essentially you're answering those questions with your expert opinion?

A. **Yes. That's a summary statement. Paragraph 3 becomes a summary statement.**

Q. And does page 3 set out all of your opinions and conclusions in regard to your analysis and investigation?

A. **Yeah. Yes.**

Q. Okay. Would you agree with me just on a general basis that what we typically refer to as a scientific method calls for formulating theories and

hypotheses and then testing them to establish whether or not the conclusions we draw are valid? Would you agree with that generally?

A. **You're asking me two questions there.**

Q. Okay.

A. **Break it into two.**

Q. Do you agree that the scientific method, or what we generally refer to as the scientific method, generally entails formulating opinions -- or formulating hypotheses or theories and then testing them to see if they prove to be correct? Do you agree with that general statement?

A. **Yes.**

Q. Okay. And on page 3 you list 11 separate bullet points as setting out your opinions?

A. **Yes.**

Q. Why don't we go through those one at a time. And starting with number 1, why don't you detail for us what experiments, calculations or testing you performed to establish each of those opinions or conclusions?

A. **We had a -- if you look at the failure location "A," you can see on the pictures, from the Coleman pictures, and if you look at Figure 8, from 7, 8 and 9, you will see the outside indication of a**

defect on the Figure 7. What was most telling is on Figure 8, the depth of the defect and how far it reached into the laminate. And when you go to Figure 9, you start looking at different colors, which indicates that some of the defects had access to atmospheric contamination, and some of them -- the delamination, some of them didn't. Which means the ones that were white and a uniform color were sealed in at the time of manufacture.

So that says that the delamination flaw existed -- oh, and the pictures also indicated that, if you look at Figure 9, you will see smooth surfaces and resin bubbles, which indicates that there was no resin contact at that point. And no bonding. So that says that they were in -- in there at the time of manufacture, created at the time of manufacture.

Q. Is --

A. And, yes, that was all done by the naked eye.

Q. Okay. And is it a review of those photographs that you just detailed for us the basis on which you formulate your opinion number 1 in your statement of expert opinion in your report on page 3?

A. That and confirmation visually when I had the part in front of me, yes, sir.

Q. And there were no other experiments, calculations or tests that you performed?

A. None needed for those kind of indications, sir.

Q. Okay. So none done?

A. None done.

Q. Okay. Let's go to number 2: "The defect was near or adjacent to the top of the pre-formed insert used to form the right side vertical rib of section 2." Was that determined, again, totally by viewing the photographs and looking at the pieces when you had the opportunity?

A. Yes, sir. The evidence is in the composite itself.

Q. Okay. Any experiments, calculations or tests you performed to establish that -- those opinions?

A. Visual indication, sir.

Q. Okay. Number 3. What is the basis of your opinion in number 3?

A. The basis of my opinion there is long experience in the composites industry. I was giving more credits to the professionalism of the build than the x-rays later showed. The start of the defects in this case can be started by machine. That flange is

very thick and very heavy. And the tool cutting forces can cause delaminations. And I was saying at this point in time, before I had the NDE, the x-rays, I did not know how far back and how extensive they -- that -- those defects were. And it was quite possible that these defects can be done when machining, because this part, remember, is formed with one continuous flange, and then the -- the cutouts or relief cutout is machined later. It's a typical problem in many composite parts.

Q. Just so I understand your answer correctly, the basis for opinion number 3 is your experience in the industry and no other experiments, calculations or tests; correct?

A. And the surface indications, yes.

Q. Okay. And didn't go down and watch any of the manufacturing process to determine whether or not your observations are correct; true?

A. That's true.

Q. And in your -- your opinion, you say the defects could have been facilitated by physical damage of the cutting tool. Do you know whether they were or not?

A. In -- it's irrelevant at this point. They could have been facilitated, opened up. What we

have is, we have some very large defects that were opened up. So cutting tools could have started it. I wanted to make sure that that was well understood, that the tools could have started the defects at this time.

Q. But you have no -- no evidence that they did? Simply that they could?

A. We have evidence of delaminations heavily exposed to the environment. For a great period of time. Which would be indication from the time of manufacture. A good indication is, if a laminate was constructed well, constructed well, you can destroy a laminate in a hurry with bad machining.

Q. Do you --

A. So, yes, it's my opinion.

Q. Do you have any independent evidence at all that you can point us to that the cutting tools facilitated physical damage? And, if so, tell me what it is.

A. On this part, no.

Q. Okay.

A. But on other parts, yes. You can find that in the literature.

Q. Number 4: "The internal delaminations and external machining damage was facilitated by dry

fiber from incomplete resin flow and wet out of the reinforcement mat at the time of molding." Were there any experiments, calculations or tests performed that you relied on to establish that opinion?

A. **Visual indication. A dry fiber is dry fiber.**

Q. So, again, you're -- that was determined by simply looking at photographs?

A. **Oh, you can -- you can touch it, sir.**

Q. So you looked at photographs and you touched it?

A. **And you're working with -- yes.**

Q. Anything else that you did that you used as a basis for that opinion?

A. **No, sir.**

Q. Okay. Number 5: "The incomplete resin flow resulted from improper reinforcement layup and mold closure as identified by Osborne on the units Aerial Platform Inspection Report." What's the basis of that opinion?

A. **You had a shop traveler -- I call it a shop traveler manufacturing record that indicated a flaw. A flaw that was identified on the edge by the manufacturing personnel.**

Q. Do you have that record?

A. **That was part of the court documents, yes, sir. You have every one that was part of the records turned in.**

Q. But I want to make sure I know which ones you're talking about.

A. **Yeah.**

Q. I don't want to have to go through them all.

A. **It was the one for the bucket, sir.**

Q. Again, when we take our break here maybe in about 15 or 20 minutes, can you find that in your file?

A. **Yeah. We can do that.**

Q. Okay. So I will make a note that we'll do that. Okay?

A. **Yep.**

Q. Anything else other than that record that you're relying on for that opinion?

A. **Well, first of all, there was no -- when I looked at that record, that same record seemed to be willfully inadequate. It was deemed okay to proceed. And yet there was no engineering function. There was no design review, no intent, no evaluation of the defect. And given that no evaluation of the**

defect, if you actually saw a fold, that affects resin flow. Now, when you do molded parts, if you have folds and -- folds in the part, you affect the resin flow and how it trains. The idea is, it needs to come in every time the same way.

Q. And I think I understand your answer there, too. But the question was, was there anything else other than that record that you relied on in formulating that opinion?

A. **That was the basis of formulating that opinion, sir. Yes, sir.**

Q. Okay. That record?

A. **That record.**

Q. Okay. Number 6: "The external flaws caused by the machining operation grew in service extending the delamination surface between plies and reducing the structural capacity of the laminate as it was used in-service until it reached the failure load condition." What machining process can you point to that caused external flaws?

A. **The machining process for the cutting the relief flange, or the relief in the flange.**

Q. And exactly what independent evidence can you point us to that would allow you to tell us that the machining operation caused external flaws in that

area?

A. **The machining operation never -- when you machine, the gap -- there are surface gaps, indications, that were opened up. That were opened up at the time of manufacture. Now, that either -- either they were likely -- since they were deep in cut, since that area was removed, it had to be done at the time of manufacture or machining operation. Because that part was whole at the time of manufacture. So when that machining tool comes in and removes that material, it opens those flaws up. The simple fact that you remove the material says you -- you created that.**

Q. And it reduced the structural capacity of the laminate. Are we talking about the strength?

A. **Yes.**

Q. Did you ever test to determine how much reduction there would be in structural capacity as a result of this flaw that you find?

A. **Well, we know what it failed at, don't we?**

Q. That wasn't the question I asked you.

MR. AHL: Would you read that back to him?

Q. (By Mr. Ahl) And listen to the question.

(The requested portion of the record was repeated.)

A. **My apologies, sir. No. The grounding assumption is, the experimental and scientific method is, you work with the knowns. The knowns are, sir, we had one person in the bucket, and it failed. And my apologies.**

Q. (By Mr. Ahl) So you have not done any experiments, tests or calculations to determine what your opinion would be regarding the reduction in structural capacity for the external flaws that you believe that you see?

A. **That's correct.**

Q. Is that a fair statement?

A. **That's correct, sir.**

Q. Okay. "At the time of" -- number 7: "At time of the failure the compromised composite resolving Mr. Keaschall's body weight into vertical rib failed in shear at or near the vertical rib insert which triggered the catastrophic failure of the bucket." Why don't you tell me the basis of that opinion. Everything that you used to formulate and arrive at that opinion or conclusion.

A. **You look at the pieces, the physical evidence in the pieces, and how they fit together and**

how the load was applied inside on the -- on the structure. It becomes apparent on how that's done. So that's how it was done, sir.

Q. Again --

A. **Visual inspection with experience.**

Q. No other testing or -- or analysis or --

A. **No.**

Q. -- calculations? No?

A. **No.**

Q. Number 8: "Mr. Keaschall would not have had any visual warning of the impending failure."

A. **That's correct.**

Q. Okay. How do you know that?

A. **Because the way the laminate is structured, the way the laminate is built, it would have been a sudden complete failure. Composites fail -- composites don't have a yield condition. Composites have a linear -- they have a linear failure. And so they're either there or they're not. It's that simple.**

Q. So based on the -- the condition of the laminate after the failure, that's the basis --

A. **No.**

Q. -- for your opinion?

A. **No.**

Q. Okay. What is? Maybe I misunderstood your answer.

A. **What we're looking at is composites as a class of materials do not have a yield like a metal part. Like you bend an aluminum rod, and it takes a permanent set. Composites, you bend it, and it breaks. It's more like a wood rod. And so he wouldn't have known much -- much different. His weight, as they were going on, it may have gone down a little bit, maybe perceptually, maybe not, every time he used it. But every time he got into that bucket, he pushed it one more cycle closer to failure. And he wouldn't have known it.**

Q. So your opinion is that this was a sudden catastrophic failure that there would be no time to determine it was occurring until it had already occurred?

A. **I'm saying that the loss of strength was progressive. Until he reached a point where the -- it failed under the load of his load or whatever he was doing at the time.**

Q. Do you believe that there would be any audible sound at the time of failure?

A. **Yes. I've thought through this. I've listened to many, many structural parts, composite**

parts, fail in my time. I've been around a lot of failing. And so putting this -- how this particular bucket would have failed, yes, I think he would have had a -- an initial -- there would have been an initial retort. Report.

Q. And in looking at your -- the materials in your file, at one time you were theorizing there was more than one retort. Have you ever formulated any opinions or conclusions as to whether or not there would be one or two?

A. **Yes. And I think, again, we go back into the evidence of the composite, or of the -- of the composite itself. And we can work that through if you want to talk through that failure narrative. That's later in this report.**

Q. And we'll get to that. But just for right now, how many retorts do you believe that there would have been?

A. **I think there was an initial large one, and then I think after that, it was -- would have sounded more like a tree branch failing in an ice storm.**

Q. And how -- do you have any opinions as to the length of time that would expire between those two events?

A. **Well, unfortunately --**
Q. Just yes or no. No?
A. **I think you're talking in something less than a second between the first and second one.**
Q. Okay.
A. **And then it happens fairly rapidly. You have to understand, you're making judgment calls there. But you can tell that there was a -- the fracture surfaces do indicate timing in events and timing of the events. But you don't have a -- a way to really put absolute numbers on those, sir. That's more of an engineering judgment call at that point.**
Q. Okay. Number 9, we'll just pass over. How about number 10? "The primary structure was not resistant to a single point failure mode and as such failed totally and completely in a manner inconsistent with life-critical applications." Why don't you tell me again what experiments, calculations or tests that you performed to establish that opinion, if any?
A. **That's a -- that's a standard of -- let me phrase this carefully.**
Q. Okay.
A. **The failure -- this particular structure did not fail softly. It did not fail in a way that**

would have allowed him to be survivable. In other words, it was -- everything was -- all the eggs in the basket were on the primary structure. The design intent -- we'll go back to that. The design intent was to have no redundant structure. And because of that design intent of no redundant structure -- structure, it's not really consistent with life-critical applications. Typically on those structures, which I -- in similar mission critical applications, you want to make sure that you have redundant pathways, redundant load carrying abilities.
Q. Are you claiming that the design of this bucket somehow is inconsistent with any standards of ANSI or OSHA? Or is this just your opinion?
A. **Well, having read -- this is my -- well, it's my opinion in working with, like I said, in many mission critical applications, life-critical applications, it's very difficult to imagine that you would put everything on a -- without a redundant structure.**
Q. Okay.
A. **And -- yes.**
Q. Are you aware of any standards or regulations that this -- that the design would have

violated in this regard?
A. **Well, I've spent some time with A92. I'm not -- having spent similar time in the composites industry and similar composite standards, I'm not sure that A92 is completely up to snuff. And I'm being generous there.**
Q. I guess I just want to make sure I understand your -- your testimony. Are you or are you not indicating that your opinion indicates that the design of the bucket would violate any standard or regulation in regard to these types of products?
A. **International or just national standards?**
Q. Aren't we talking about a national product?
A. **Let's answer the first one. Inasmuch as ANSI A92 is written, it meets it.**
Q. Okay.
A. **But the question is, is that sufficient.**
Q. Would that be one really good reason for someone like Mr. Keaschall to have been wearing his fall protection gear on the day of this accident?
MR. BEUCKE: Let me object to the form of the question as ambiguous. I don't know what you mean by would "that" be, by "that."
MR. AHL: By "that," when he's saying on

his opinion number 10 that there are no redundancies and that this may not adequately be a safe product because it can just fail. Not in a soft mode.
Q. (By Mr. Ahl) Do you understand that?
A. **I understand that. Let me give you an engineering judgment and a little self-reflection here, because I have been -- worked in high steel and I have worked in high places. Not necessarily with the five-point harnesses that are being used. I'm not sure that I would have taken the straight jump as opposed to being hung on a tether. Certainly the tether that Altec is recommending, the short, four-foot length. He had the -- he had a longer one, which was quasi legal at that time. But he had no fall -- he had no interference for him when he fell. So he could have -- that was OSHA legal for him to be on a long tether.**
I'm not so sure I would have taken a jump and being swung into or part of that very sharp guillotine that he was hanging by. I'm not sure that would have been a survivable accident. I would have taken the jump straight down.
Q. So, in your opinion, it's better off that he was not wearing his fall protection that day. Is that what you -- is that really what your opinion is?

A. I think it becomes very debatable when you look at where the fall protection would have put him. The fall protection -- the fall protection that he was -- that Altec has asked to use, the four-foot, does not predicate that the bucket has failed. There is -- it is predicated that the bucket is in place and the fall protection is keeping you in the general area of the bucket. But there is no -- the simple fact that this bucket failed and created exactly the hazards that keep one from using the six-foot lanyard, or the longer lanyard on a boom truck, from happening -- or around, keep one from specifying the longer lanyard instead of the four-foot, gives me great pause and makes it not necessarily such a very sure thing.

And when I look at -- like I said, you take a look at those pictures and you think about hanging -- dangling and hanging out under that very sharp guillotine, because that's what it is, and being drug under that, I'm not so sure that would have been -- that would have been a suitable -- or an alternative that I would have accepted myself. And let me put it that way, since I can only evaluate on how I would have thought at the time.

Q. Okay. And I'm asking for your expert

opinion, and if -- if you're called up to the witness stand and you're asked the question that based on your opinion number 10 should Mr. Keaschall have been wearing his fall protection on the day of this accident, are you telling me that you're going to tell the jury that your answer is either no or you're not sure?

A. I'm saying on number 10, this bucket was designed -- it would have been very easy to put -- to tie the bottom floor of the bucket into the ribs along the top. There were things that could have been done to this design to make this survivable.

Q. And we're not talking about them.

MR. AHL: You want to read the question back to him again?

A. Well, you were asking about 10.

Q. (By Mr. Ahl) I said in light of number 10. Let's answer the question about the fall protection, of what you're going to tell the jury if you're asked the question.

MR. AHL: And let's have -- have you read that back to him.

(The requested portion of the record was repeated.)

A. What lanyard, sir?

Q. (By Mr. Ahl) The lanyard that he had with him that day.

A. That, sir, is very much of a judgment call when you believe -- when you look at how this thing failed. I can only answer how I would have done it.

Q. Well, I -- are you --

A. I can only answer for myself.

Q. Well, let me just ask you this, then: Are you telling me that you don't have a professional opinion as to whether or not he should have had his fall protection on on the day of this accident? And that's fine if you don't have an opinion.

A. I would -- yes. I don't have an opinion at this point, sir.

Q. Okay.

A. I think it's -- I think it's -- in my opinion, though, it is not a sure thing.

Q. Does ANSI require fall protection to be worn on --

A. OSHA requires it.

Q. Does OSHA?

A. Yes.

Q. Does ANSI, do you know?

A. I never saw it in the -- in the standard,

they require lock-off points. Typically the way ANSI standards are written, operational issues are not normally found in design standards.

Q. Did Mr. Keaschall's employer require that he wear fall protection while performing the job he was doing that day?

A. I believe he -- yes, sir.

Q. Would he have been in violation of the OSHA standard that day at the time of this incident for not wearing his fall protection?

MR. BEUCKE: Let me object to the form of the question as I think it may exceed this witness's expertise and area of opinions.

Q. (By Mr. Ahl) You know what the OSHA standard is, don't you?

A. I'm aware of the OSHA standard. I didn't read it, but like you said, you want to be -- my charter here is to testify to the composite as much as possible, sir.

Q. So are you telling me you don't have an opinion as to whether or not his lack of wearing his fall protection that day would have violated the OSHA standard? You don't have an opinion or you don't know?

A. Let's say I don't know, sir.

Q. Okay. Let's go to number 11. "The primary reinforcement used in the design and identified as short fiber, random mat has little capacity to resist flaw propagation and was improperly applied in the design without suitable long fiber reinforcement to provide fracture toughness and control of cycling tensile strains in the laminate."

A. Yes.

Q. That's your opinion?

A. Yes, sir. That's my opinion.

Q. Okay. And can you tell me what the basis of that opinion is?

A. If you look in design handbooks, if you look in the great body of work in the composites industry, short fiber, random mat is not used in tensile mode. At least in structural. It is filler. It is core material. And, in fact, I had to work really, really hard to find what the allowables were for the material as opposed to interdirectional or cross-ply reinforced cloth fabric.

And let me put this in perspective. You're asking the difference between pressed dryer lint and a tea towel as far as strength. Because that's what short fiber, random mat is. Basically,

pressed dryer lint. And when I talk about long -- suitable long fiber, you're talking loading materials like a tea -- like a towel or a tea towel or washcloth, something that has some physical strength and pull. As long fiber can carry load. A bit of long fiber going around the -- the flange of this bucket probably would have saved his life. And that's what I was talking about, is -- on number 10.

Q. Did you do any testing, experiments or calculations to determine what effect the use of random -- of the short fiber, random mat had in regards to the strength of this bucket?

A. You will find -- in my references, you will find reference materials on -- on the different materials and their lack or whatever strength you would call out on them, sir.

Q. Okay. Did you do any testing, though, to determine what effect it had?

A. Not on this bucket.

Q. No? Okay. Did you do any testing or any analysis to determine how much short fiber or random mat was used in the manufacture of this bucket?

MR. BEUCKE: You say how much?

MR. AHL: Yeah.

Q. (By Mr. Ahl) What quantity? Let me...

A. If you're looking for -- no. Let's answer that no.

Q. Okay.

A. Let's not delay that.

Q. Why don't we take about a ten-minute break or so, and if you could find those photographs for me while we're doing that in your file, I'd sure appreciate it.

A. We need one photograph and one exhibit.

Q. Is that what we're looking for?

A. I believe, sir. Yes, sir.

(At this time a brief recess was taken.)

(Exhibit Nos. 105 and 106 were marked for identification.)

Q. (By Mr. Ahl) Okay. We just took a short break, and you have secured a couple items out of your file for me that we had talked about in earlier testimony but didn't have the actual exhibit. We now have an exhibit marked 105 and exhibit marked No. 106. First, let's go to Exhibit No. 105, and why don't you identify what that purports to be?

A. This is an inspection report. It outlines the -- I normally call this a shot traveler, but it gives you the information of -- during the

build of this particular bucket. By serial number.

Q. And do you know, is this the record that corresponds to the bucket that failed, or do we know?

A. Yes, it is, by serial number, I believe.

Q. Okay. In your prior testimony, you indicated that there was something in this record that gave you concern and that you found significant in regard to the failure of this bucket?

A. Yes.

Q. Why don't you tell me what that is and point out to me where that is reflected in the record?

A. You have, in the middle of the sheet, it says, "Observed Discrepancies." Wrinkle is checked, rib side. That's the one that stands out to me. There's an "Air." It says skid, in flange. I'm assuming that that means it was open. Don't know about that, but I know what a wrinkle is to me, and that's a wrinkle visible from the -- on the outside of the -- on the layup when the mold was closed.

Q. Anything else that was of particular importance to you in the record which is Exhibit No. 105?

A. Well, there's lots of -- I have lots of questions on it, but...

Q. And let's set those questions aside for a minute. Is there anything significant to you in that record as it would relate to the -- to the failure of this bucket?
A. Based on the information disclosed to me, nothing discernible.
Q. Okay.
A. If there was more information, that may change.
Q. Okay. And you indicated that the one thing of significance to you is the checkmark that says wrinkle, rib side?
A. Yes.
Q. What's the significance of that?
A. When you lay material into a mold, especially a closed mold, and on resin transfer manufacturing process, consistency is everything. Consistency of resin flow, consistency of fill. That speaks to the recurring quality of the part. Anything that affects resin flow can channel resin and cause dry spots and can cause weakness in the -- in the -- in the part itself.
What's concerning to me was, when I see these known discrepancies, no review by the design authority on what was acceptable or not. There's no

guidance here on what is acceptable or not. There is no guidance on how much resin content is suitable. There's no validation of any of the numbers here in the design record. That's part of the many questions that I have. And that requires, again, someone who knew design intent to make those calls.
Q. Where you're talking about the folds or the wrinkles and the effect on lamination, is that what we're talking about?
A. Strength, yes.
Q. Strength? Okay. Did you ever evaluate the structural significance of the folds or the laminate in the area? Or do you even know what area they're talking about?
A. Rib side.
Q. Okay.
A. That's on the side of the failure. Anything that would affect the channeling of that flow would affect -- this is on the side of the failure. Let's -- let's put it in the worst possible location, is right on top of the rib.
Q. Let me ask you this: Did you evaluate in any fashion, either through testing, analysis or any other method, the structural significance of the wrinkle on the rib side? Did you?

A. No.
Q. Would that area that they described be in what has been referred to throughout your report as location "A"?
A. That would be the intent. When you're looking at changing the mold or changing how this -- how the resin is flowing, it could be anywhere in between the ribs. Anywhere in that distance is what I would be worried about, sir.
Q. Do you know whether they're referring to what you have called in your report location "A"? In Exhibit No. 105 where they're talking about --
A. They say rib side.
Q. Okay. So you don't know exactly?
A. That's correct.
Q. Okay. The design of this bucket has features where, from an engineering perspective, the bucket is to carry the weight load; is that correct? Of the occupant.
A. There's a spec on what it's -- their intent for it, yes.
Q. Would you agree that the platform is designed to carry the load of the weight on its floor?
A. No. I -- you're talking about an

integrated structure. You're asking me -- I guess you're going to have to speak more specifically.
Q. I guess, when the bucket is in use, you have an individual and tools in it, where, in your opinion, is that bucket designed to carry the main load of that weight?
A. You stand on the floor.
Q. Is there a scientific method that you could use to determine through a scientific analysis where the stresses on the platform would normally be when the -- when it's loaded?
A. If you knew how it was built, yes.
Q. Could you do that with what -- what do they call it? A final element analysis or something like that?
A. Yes, you could.
Q. Okay. And that would determine where the stresses are on the platform when it's being utilized?
A. It would take -- yes.
Q. Okay.
A. A suitable expert could do that job, yes.
Q. Okay. Did you do that?
A. No.
Q. Do you know whether it's been done in

this case?
A. **I know there was an attempt.**
Q. Do you -- do you know whether it's been done?
A. **Let me be very specific.**
Q. That's what I want.
A. **None was -- none was disclosed by Altec for the design or build of the bucket. The only FEA that I am aware of was done after the failure.**
Q. Do you know what the one done after the failure showed as far as where the stresses on the platform were when it was loaded?
A. **Let me be very --**
Q. Well, just yes or no --
A. **-- generous.**
Q. -- first. Do you know whether there was one done after the failure by anyone?
A. **Yes, there was one done after the failure.**
Q. Have you seen the results of that?
A. **I've seen one plot of it.**
Q. Who did that?
A. **That was Mr. Rakow.**
Q. Okay.
A. **Rakow.**

Q. Yeah. Do you know what that analysis showed in terms of where the stresses were on the platform when it was loaded?
A. **I'm going to be very specific again.**
Q. Okay.
A. **The plot that Mr. Rakow put in his report would not be acceptable, credible analysis in any expert composites that I'm aware of.**
Q. Do you know what it showed?
A. **Yes.**
Q. What did it show?
A. **It showed von Mises stresses located at the bottom.**
Q. The floor of the platform?
A. **No. On the rib -- connection to the rib to the side.**
Q. The mounting bolts?
A. **No.**
Q. Where?
A. **His highlighted on the very -- was on the bottom of the rib connecting to the side wall. I'm going by memory, sir.**
Q. Okay.
A. **And we -- we have that here if you want to.**

Q. You want to take a look at it just to make sure you've got it?
A. **No. I've got it in memory, sir.**
Q. Okay. Did it show anything about location "A," whether or not there was high stress or low stress in that area?
A. **Well, if it would have been done properly, it probably likely would have.**
Q. Again, I know you want to answer whatever question you want to formulate in your own mind. But that's not the question I asked.
MR. AHL: Read it back to him.
(The requested portion of the record was repeated.)
A. **His analysis, no.**
Q. (By Mr. Ahl) Didn't show anything in that regard?
A. **That's correct, sir.**
Q. You seem to be very critical of the methodology?
A. **Absolutely.**
Q. Why don't you tell me exactly what all your criticisms are so we can address them with Mr. Rakow?
A. **Von mises stress is an inappropriate**

failure criteria for composites, period. He would have been -- carried a little bit more credence if he would have said von Mises strains. He would have been even a little bit more if he would have talked about first principal strains. But when he said that, the question now is -- begs on what was his material properties, how did he lay it up, what elements did he use, how the material elements laid in there.
Obviously he did not include the difference in stiffnesses of the material of the rib and the flange. It looks like the material was treated -- the bucket was modeled relatively isotropically. Not modeling the Rakow version. And so if he didn't model the Rakow version, if he didn't come back specifically with -- you know, if he came in and took a CAD model, a 3-D CAD model, pushed the button and said give me tet -- condensed tet elements, laid material properties in, he's going to get an answer or a result that would not be meritable in any -- in any peer review that I'm aware of.
That was one of the reasons why I was going after the second bucket, was to do a credible design or credible design FEA. Suitable for this. But when I realized that we had no way to develop the

as-built condition of the Keaschall bucket without systematically destroying it, that's when I said, we can't do that.

Q. So you think that Dr. Rakow's tests just show nothing as far as the final element analysis?

A. **I think Mr. Rakow has to provide a great deal of his input and of his analysis. And I'm being kind there, sir.**

Q. In your report you come up with, on page 4, your responses to questions of interest. Going back to your original report.

A. **Yes, sir.**

Q. And question of interest number 1 is, did Altec slash Osborne use reasonable care in the manufacture of the bucket?

A. **Yes, sir.**

Q. Your response to that was no?

A. **Yes, sir.**

Q. Can you tell us the basis upon which you formulate that opinion or conclusion?

A. **The lack of disclosures.**

Q. To whom?

A. **To the court. They were an ISO 9000 company. They have an ISO 9000 certificate hanging on their wall. It was in effect at the time of**

build. ISO 9000 requires significant design control and management of risk. None of those documents were produced for this. Having none of those documents, that's on the face of it.

Q. Other than not having the what you would feel to be appropriate disclosures, do you have any other basis for your opinion as expressed to question of interest number 1?

A. **When they did the manufacturing -- let's go look on -- let's be very specific and walk through this.**

Q. Okay.

A. **Who was -- the question is, and it still is in my mind, who's the design authority for the bucket? I'm not -- that's not clear in my mind. Who had -- who had final design authority here? If it was Altec, they should have had shipping and receiving documents that said, we're buying what we're getting. And we have an e-mail in the record that says, we have no idea where these -- these -- the tests that were asked.**

They asked for the tests to the -- the specification. And you look and you say, people weren't -- the two institutions weren't effectively doing their jobs. And when I look very specifically

to process FMEAs -- failure modes and effects analysis -- control plans, all the things that would have provided input to this document, I'm not seeing any of those. If they exist, I would might change my opinion, sir. But the lack of disclosures, the lack of specific disclosure on those issues, I have to say, based on what I see, no.

Q. And that formulates the entire basis of your opinion as to the lack of disclosures and lack of information that's been provided to you?

A. **Yes, sir.**

Q. Okay. Let's go down to question of interest number 2, "Did Defendants Altec slash Osborne use reasonable care in the design of the bucket?" And, again, your response is no. Why don't you tell us specifically what you use as the basis of that opinion?

A. **Where was the responsible individual? Who's the design authority? Who is the competent authority that signed off on the drawings? Who did the validation? Who did -- where's the work product? This is all that was disclosed on this bucket. Where's the work product, other than some drawings? There's nothing here that says this design was suitable. This design meets my -- I have an intent,**

and it meets my intent. And that goes really to the core of the design function. And if you can't produce it and you don't have that in the files and you're not managing it as far as your ISO 9000, yes. On the surface, sir, no.

Q. Is that, again, the total basis of your opinion, the lack of records and lack of disclosure that have been provided to you, upon which you formulate your response to question of interest number 2?

A. **Yes.**

Q. Question of interest number 3: "Did Defendants Altec/Osborne adequately warn of the dangers of the use of the bucket and the need for periodic inspection?" Your response to that is no. And, again, you say based on disclosures provided and the manner of this failure. Why don't you tell us exactly what you used to formulate for the basis of your opinion?

A. **The type of failure -- Altec was very good on inspection. But they were inspections for electrical characteristics. There was no -- very -- there was very, very little specific inspection criteria to the safe use of the structural intent of the -- of the bucket. And we find that in several**

cases. Because third-party inspectors had already passed off on the inspection of this bucket.

Quite frankly, when somebody with a practiced composite eye came across it and saw the edge delaminations, I knew there was a significant problem with this design or with this particular bucket, especially the one I removed from service. None of that indication, no guidance on what individual indications were provided in Altec's information. So based on that, no.

Q. Anything else?

A. No.

Q. Question of interest number 4: "Was the bucket defective and unreasonably dangerous for its intended use or any use Defendants Altec/Osborne could reasonably foresee?" And your answer to that is yes. Why don't you tell us each and every element that you used as the basis for that opinion?

A. The evidence put in front of me was the same in 4.3. The evidence and the materials placed in front of me.

Q. I don't understand your answer.

A. Well, you were -- let's -- okay. Let's go through my rationale. Osborne was known -- had a bucket with known folds or visual indications. It

had a known, in their words, discrepancy. I saw no -- in their known discrepancies, there was nothing in the manufacturing record, there was no work product that said, this is okay. Nothing in Altec or Osborne information said, this is going to be okay. There was no testing to validate it. So based on that, giving no concurrence of the competent design authority, then you have to say -- you have to say -- you have to err on and say this bucket was defective.

Q. Again, you didn't do any testing yourself to determine what the effect of the known folds or visual indications at the time of manufacture were, did you?

A. No. As already answered.

Q. So you don't know whether or not that even had any structural significance on this bucket, do you?

A. Oh, I know it had structural significance, sir, based on the visual indications and the failure --

Q. You just don't know the extent of that significance?

A. We know it failed, sir.

Q. You didn't test it, did you?

A. No. We didn't do tests.

Q. If you really want the answer to some question, isn't the way you do it in science to test? Isn't that the way you do it?

MR. BEUCKE: Let me object to the vague form of the question.

Q. (By Mr. Ahl) You can still answer it. Isn't that the way you determine an answer in science, is to test something?

A. If I see a thousand parts fail, and I see duplication of failure modes, if I see duplication of failure surfaces, you can start to read the composite. In this case, it failed. I would have loved to do testing. Unfortunately, to do any valid testing, I would have had to destroy the evidence in front of us. Because I'm not -- can't find another bucket like this.

Would have loved to do some testing. Would have loved to put it into analysis. But the simple fact is, this bucket, based on the x-ray indications, stands unique. And because of that, we have to go on the visual indications of what we have. Unless we destroy it. And the thing is, it's already been destroyed.

MR. AHL: Read the question back to him. I'll move to strike that as being nonresponsive, but

read the question back to him.

(The requested portion of the record was repeated.)

Q. (By Mr. Ahl) Yes or no?

A. Yes.

Q. In your first report, you also on page 19, which is section 8 of your report, come up with what you call commentary. Which, am I correct in my reading of that, that you're trying to recreate how this -- this incident occurred? Reconstruct it in a fashion?

A. Yes.

Q. In attempting to reconstruct the incident, did you do any testing, modeling or analysis that allowed you to formulate any conclusions or impressions that you came up in regard to how this actually occurred?

A. You lay the visual -- the visual indications of the parts themselves dictate how the accident progresses. In -- you asked modeling?

Q. Yes.

A. You put the parts together, and you see how it comes together. Is that any less different than doing it in a computer? If you're having the physical parts? If you're doing analysis, if that --

Q. Did you do any computer modeling?
A. **No.**
Q. What exactly did you do to allow you to come up with your commentary and reconstruct how you believe this incident actually occurred?
A. **I looked at the evidence and the laminate itself. I looked at how the load was on it. And how it was -- how it was in service. I looked at how, mainly -- mainly, the first thing is, you look at the laminate. The laminate tells you how it fails. Irregardless of what load was applied, it tells you how -- what happened and where and how it proceeded.**
Q. Do you also look at the direction of travel of the different components in relation to their final place of rest to where they were at the time the failure occurred?
A. **At the time that this report was written, I had no way to place the bucket in space. But I could tell which direction it headed out relative to its own -- to itself.**
Q. Did you have a way to determine how far it had traveled either in an up-and-down fashion or a lateral fashion?
A. **It wasn't important to my analysis at the time.**

Q. Okay.
A. **My analy- --**
Q. So you didn't do it?
A. **No. My analysis at the time was to -- was to stay focused on what the laminate was telling me.**
Q. Okay.
A. **The evidence in there.**
Q. Have you done anything further since your first analysis that would allow you to formulate cause and effect in regard to the movement of different components involved in the incident?
A. **My third report discussed potential cause and effects of the...**
Q. Have you done any modeling or testing or analysis in -- in terms of mathematics or anything else as a basis for your reconstruction of this incident?
A. **Very minor. But let's say no.**
Q. Okay. Ben Railsback's deposition was just taken here shortly. And a copy of his file was secured, which involved some records which included some records of computer modeling that he did --
A. **Mm-hmm.**
Q. -- in a reconstruction of this incident.

Have you seen those?
A. **No. I have not had that in my possession or seen them.**
Q. Okay. One of the things that Mr. Railsback was talking about was the movement of the bucket after the failure.
A. **Mm-hmm.**
Q. You've seen his report in that regard?
A. **Yeah. I have some issues with that one, but that's okay.**
Q. Okay. That's what we're here to talk about, is your issues with it. Okay?
A. **Okay.**
Q. Have you ever seen his opinions and conclusions modeled in a computer as far as the amounts of energy he says was necessary to move different components?
A. **No, I have not -- not did that.**
Q. Do you have the ability to compute a model?
A. **To computer model that?**
Q. Yes.
A. **No. But that's simple free body motion. That should check out with -- that's first year engineering --**

Q. Okay.
A. **-- on a hand calculator --**
Q. Okay.
A. **-- for -- to scope that out. You won't get it within inches, but you should be within feet.**
Q. Okay. And that's how you did it?
A. **I didn't do it, sir.**
Q. Okay. You didn't even use a hand calculator? You just looked at it and --
A. **I told you from the very beginning, I looked at the laminate. It was interesting to me that Mr. Railsback validated the positioning and the exit direction that was indicated on the bucket. He did -- he did indicate the same. We did come to the conclusion of what direction it went away from the boom mount.**
Q. Do you agree with Mr. Railsback that at the time of the failure of the bucket, it not only moved vertically, but horizontally as well?
A. **Sure.**
Q. And you accept that the bucket ultimately hit the rail of the truck before striking the ground? Do you agree with that, or do you disagree with that?
A. **I think beyond a question kind of question, the bucket hit the truck. I've seen a**

great deal of structures dropped, and they can bounce. So whether or not the primary impact was in the dirt and we couldn't see it because of the roughing up and it bounced into the truck, or hit the truck directly, we don't know for sure. But it did hit the truck. I think a good engineering adjustment is, is that it hit the truck first before it hit the ground.

Q. So you do accept that?

A. **I say it's valid. It's a reasonable assumption. But it's not — specifically, it's not without question. And I'm being very specific here to answer your question so we — so you understand.**

Q. And I'm just wondering, in your version or your commentary or your reconstruction of this incident, are you assuming that when that bucket failed and fell, that it first struck the truck before --

A. **I think it's very reasonable to consider that, yes, sir.**

Q. Is that what you're assuming with all your -- your analysis?

A. **Yes. I think that would be fair to believe, that it hit the truck. But I want to be very clear. When I state engineering opinion, I**

make — make sure that there's between — if there's any room for error or any room for variability. That bucket could have hit the ground and bounced into the truck. I have seen composite structures bounce.

Q. How far from the truck did the bucket end up at its point of rest, do you remember?

A. **Don't care.**

Q. Doesn't make any difference to you as to whether it hit the ground, bounced up, hit the truck and went somewhere else?

A. **No. Nope. That wasn't -- you're talking out — when it came — when it came loose of the truck. At that point it becomes a great deal of conjecture, sir.**

Q. Do you know how far or -- or are you assuming that the bucket moved horizontally a certain distance from where it was at the time of failure to --

A. **I think the horizontal distance could be anywhere from four feet to six feet, I believe, somewhere in there. I'd have to go look at the — the plots and figure it out. It means if you include the width of the bucket itself.**

Q. Well, we know where the bucket, based on the mark on the bottom of it, struck the truck, don't

we?

A. **Right.**

Q. And we know where that rail on the truck was?

A. **Right.**

Q. So we know how far the bucket was over the truck when it actually struck; correct?

A. **What I can tell with certainty is, I can — I can tell you the exit direction that the bucket took away from the boom. That's what I can do with some reasonable certainty.**

Q. Past that, you can't do much with reasonable certainty?

A. **It becomes conjecture, sir, at that point.**

Q. Okay.

A. **A good engineer — at that point your engineering judgment comes in. And we can — I'm sure that you — we'll talk about that later, as we go on.**

Q. You would agree with me that given gravity and given the weight of the bucket, there's a certain length of time it would have taken from the time it detached from the boom till it struck the ground?

A. **Yes, sir.**

Q. And if it hit the truck, it also had to move horizontally at a certain rate of speed --

A. **Yes, sir.**

Q. -- before it got to a point where --

A. **Yes, sir.**

Q. -- the truck was off the ground?

A. **Yes, sir.**

Q. Have you calculated those?

A. **No.**

Q. Have you calculated how much energy it would take to move the weight of the bucket, the distance that it moved horizontally, from where it was on the boom to the point that it struck on the truck?

A. **No.**

Q. Do you have the ability to do that?

A. **Yes.**

Q. Any reason you haven't?

A. **Because it wasn't necessary.**

Q. Okay. If you haven't seen any of Mr. Railsback's file, I don't assume that you've seen the computer model that he did of your commentary and how you --

A. **No.**

Q. -- say --
A. No. I have no idea. I haven't seen it at all, sir.
Q. Okay.
A. But I do have some — I did listen to him discuss, and I can — I can — from his verbal indication of that, I would — I would probably say that his initial conditions were probably not what I was intending. It all comes back to the initial conditions you use.
Q. Are you critical of Mr. Railsback's reconstruction of this accident as he computer modeled it?
A. Oh, I think — I think his physical orientation was nicely done. Good work on the modeling and laying the — taking the pictures. Those are things that I could not do. But I think what he lacks is an understanding of what — how the composite and — the interaction of how the composite fed into that picture. And I was reasonably pleased on — that when I said how the — the bucket failed and what direction it probably exited was in the direction of where he had put it in the — in relation to the buck- — to the truck. And so that's why I said, it's reasonable to assume that the bucket

hit the truck first before it hit the ground. Not with an absolute certainty, but it is quite reasonable to believe that.
Q. You were listening to -- to Mr. Railsback's testimony?
A. Yes, sir.
Q. Did you hear him testifying about the amount of force that he believed was necessary to move the bucket horizontally and the time that it would have taken to arrive where the truck rail was? Did you hear that?
A. Yeah. I heard that. And I have issue —
Q. Do you disagree with that?
A. Well, I'm not so much disagreeing with it, but I have a question for Railsback on — on that is, if -- I want to be careful. This is a cup. If this is the bucket, okay, and it has to move from here to over there, his — he said it had a side load. He gave a fairly high side load to move it over the time. The question is, is he applying that load all the way over that time? He never — he wasn't ever really clear.
Because, quite frankly, there's no rocket motor on that bucket. It isn't being thrusted over that way. It all has to come from — that load would

be better quantitized as — in engineering as impulse momentum. Okay?
Q. Mm-hmm.
A. Instead of having a load over that time, it would be more of an impulse momentum. And that would be more attuned to, have you ever bounced a ball on a table?
Q. Sure.
A. You bounce a ball, and the ball absorbs the energy and kicks back. What makes that work, sir, is the ball stays a ball. It absorbs the energy and gives it back to you. If the bucket would have hit something and failed, that would be like trying to bounce an egg. When you bounce an egg, you drop it on the table, the eggshell cracks. It doesn't bounce. The energy absorbed, and that would have hit and basically stopped. It wouldn't have been any side force to that.
Q. So that's how you understand Mr. Railsback's reconstruction? He's talking about a -- a collision effect creating --
A. I'm asking how he — how that horizontal force would get there. And I'm questioning the physics of how that would happen.
Q. You agree that it would take a certain

amount of energy, however, to move that bucket laterally before it struck the ground?
A. Yeah. But can — can I give an analogy here?
Q. I just want to know if you agree with that first.
A. Yes.
Q. Okay.
A. Yes.
Q. And you've not calculated in any fashion in your own mind the amount of energy it would have taken to move that bucket the distance horizontally that it moved while still moving vertically down to strike the rail of that truck?
A. Right. But the issue is, is the — what you're — my problem is, Railsback and Rakow aren't — they're not listening to the commentary or the narrative on how this failed. Or what — they're not -- let me put it this way: They're not looking to the evidence in the composite, in the laminate itself. And let me give you a bit of analogy to get started. Have you ever thrown bales out of a barn?
Q. No.
A. Never thrown bales out of a barn, of a hay mound? One guy can take a bale and basically

load the truck just by a little bit of a swing. They can load and stack those bales and make it real easy for the guys on the ground. You can throw a bale quite a ways if you've got height, horizontal distance. It's very easy.

What -- the point I'm trying to make here is the composite says the floor of the bucket was in motion. When "A" failed, that bucket was twisting down. It had an angular velocity. It had an angular momentum. That's different than just straight dropping. Mr. Railsback kept saying, oh, it hinged around this point. That's not what I'm saying. This bucket, when it failed at "A," broke loose and started down. And started loading at "B." Which would have been the second noise, by the way.

Q. For less than a second, is what you told me before?

A. Yes.

Q. Okay.

A. Based on what I'm seeing is -- is -- and there's also, when "B" failed, you can see exactly when "B" failed when you look at the fracture surfaces on that -- on the far wall. It's in a "V." The point of the "V" is where "B" failed. So this bucket has broken loose. It's -- it's hinging down.

I wish I had a Dixie cup. The bucket is hinging down away from it. And it's in motion. It's started down. It's being slowed down by "B" and at the corner. But when "B" breaks, that shear plane reverses sides. It also reverses sides and comes out of that corner and snaps through and breaks in the corner and exit in the direction that I, from day one, identified.

That motion, how much energy, how much angular momentum was in that at that point when it was in motion and still attached, and that was when I was saying is, this is like dropping a pendulum. You have a -- you know, a pendulum or a ball on a string, and you drop the ball and then you cut the string somewhere in mid-drop, it's going to go sideways. And that's what we had here. This thing -- we had a weight on a string. It was dropping. It was swinging through. And we snapped the string, and it went sideways.

Q. And you believe that the sequence that you have just described created enough energy to move that bucket from its place where it was on the boom over to where it struck the rail on the -- on the truck?

A. I said it left in that direction,

explicitly, without a doubt. I said after that, it's reasonable that it had enough energy to hit the truck. To be clear, I have seen large composite parts bounce. It is not without the realm of reason this thing could've hit dirt. It bounced into the truck. But I said it is beyond -- a good judgment would say that it had enough energy to hit the truck.

Q. Do you know where on the truck this hit?

A. Yes.

Q. You think it bounced up, how many feet up into the back of the bed of the pickup and hit the railing? Is that what you're telling me?

A. Have you ever seen parts bounce?

Q. Is that what you're telling me?

A. I said that's a possibility.

Q. Okay. Do you have any evidence of that?

A. No.

Q. Okay.

A. And there's none there, I said, but it's a possibility, sir.

Q. So we could just sit here and think of a million possibilities, but we have no evidence of them?

A. You have an evidence that it hit the truck.

Q. Okay.

A. You don't know what happened before or after that, sir.

Q. Okay.

A. Objective fact is, it hit the truck.

Q. Any other criticisms that you have of Mr. Railsback's reconstruction of this incident?

A. Like I said, I think his spatial orientation was good. I -- I had no qualms with it. I -- he did -- he laid out the spatial orientation. And his direction of the impact, the location of the impact of the truck relative to the boom and relative to where the bucket would have been in space fits the evidence in the composite.

Q. Let me ask you this: If through the application of physics and engineering principles we would determine that the failure mode that you have described would not create enough energy to move that bucket from where it was located on the boom over to the railing where it struck the truck, would you agree that your reconstruction could not be accurate?

A. No. The evidence is in the composite. You first go to the objective evidence, and the objective evidence is in the composite. After that, it becomes subject. It's pure speculation. The

evidence in the composite is what you must go with, because it's objective in front of you.

Q. But we agree that it takes a certain amount of energy to move the bucket from its place on the boom over to the railing on the truck; correct? We agree that that has to be?

A. **Right.**

Q. And if your analysis or your scenario or your commentary, based on the application of engineering principles and physics, wouldn't allow for the creation of enough energy to make that movement laterally before it would strike the ground, would you agree that your commentary or your analysis or your reconstruction, whatever you want to call it, has to be wrong?

A. **No.**

Q. Okay.

A. **Because, again, we go back to the evidence of the -- what's -- how the story is told in the composite.**

Q. Okay.

A. **You're asking me -- you're asking me to take --**

MR. BEUCKE: Hey, he's finished with his question.

THE WITNESS: Okay.

Q. (By Mr. Ahl) Other than the description of your commentary in your reports, have you done any other testing, analysis or mathematical computations regarding the reconstruction of this incident? Other than what you have in your reports?

A. **No. The only interpretation is -- I was the sole interpretation of the x-rays.**

Q. Okay. You've been provided with a copy of a report from Dr. Rakow?

A. **Yes.**

Q. And you have authored a rebuttal report in which you're critical of some of his methodology and opinions and conclusions?

A. **Yes, sir.**

Q. You've told us about the criticisms that you have of his -- what do you call it? The final --

A. **Finite element.**

Q. Finite element analysis. Any other testing methodology that he employed in his -- in reaching his opinions or conclusions that you're particularly critical of?

A. **Well, it would be nice if he would have tested a Keaschall bucket.**

Q. You believe that the buckets that they

ultimately did the testing on were different than the bucket that was involved in this incident?

A. **The x-rays objectively say yes.**

Q. Did you do any testing or analysis or calculations to determine whether or not the changes affect the structural integrity or affect the performance of the bucket?

A. **Be more specific. There were several changes.**

Q. Well, which ones were you talking about?

A. **I'm talking about them all, sir.**

Q. Okay. Well, which ones do you have shown in your x-rays? Aren't they of the --

A. **Internals.**

Q. Well, let's go through. Why don't you tell me all of the changes that you believe are present in the buckets that Rakow tested in connec- -- in regard to the one that was involved in the Keaschall incident?

A. **Well, you have the buckets that you qual'd. We have no idea what they qual'd. Their qualification testing, I have no idea what they tested. But we do know that after qualification tests were done, they made a significant drawing change. Without any testing. So there -- there's a**

change there.

Q. Okay. And what was that drawing change?

A. **That was, they cut the flange in an extra half inch. It was part of the machining that we talked about earlier.**

Q. Do you know why they did that?

A. **I have no idea, sir. But it's there.**

Q. Did that in any way relate to the lanyard or the -- the place on -- for the lanyard to be?

A. **Don't know, sir.**

Q. Okay.

A. **All I know is they made a -- they violated their spec when they did that.**

Q. Well, let's take that change. And that's the one that you've really been pointing to is the difference with the Rakow testing, isn't it? Or is there other ones that you believe are --

A. **Well, you were asking me to go through the changes.**

Q. Okay. Well, let's go through them all, and we'll get back to this one.

A. **Okay.**

Q. Okay. What other changes?

A. **You have internal differences on the fabrication of the bucket.**

Q. What are those?
A. **We have a -- on the Rakor -- on the Rakow design, we have a solid, prefabbed insert for the rib structure. Which is not found on the other ones. Or it's just -- if there is a prefab, it's completely different by the morphology of the x-rays.**
Q. What else?
A. **That's enough, sir.**
Q. Can you think of any others? I don't want to hear about them later.
A. **That'd be my biggest problem, sir.**
Q. Okay. And of the ones that you just delineated, did you do any testing or calculations or experiments to determine whether or not any of those changes affected the performance of the bucket or the structural integrity of it?
A. **No.**
Q. You just know that they were made?
A. **Yes.**
Q. Okay. I believe that in your opinions, you have indicated that you believe that the failure of the Keaschall bucket started at what you've identified as location "A"; is that correct?
A. **Yes, sir.**
Q. What do you understand of the testing

that Dr. Rakow and Osborne did that you're critical of because of the change of the design of the bucket? What did they do?
A. **Well, it comes to design intent.**
Q. What did they do in the testing?
A. **They attempted to duplicate the crippled condition. And when I say attempted, that doesn't mean they were successful.**
Q. Okay. And obviously you don't believe they were?
A. **No.**
Q. Okay. And why weren't they?
A. **Because when -- they didn't understand the design intent between the two buckets, or the two designs.**
Q. I may misunderstand your report, but this is what I get from it, and you tell me if I'm misinterpreting it. That it was the delamination or the defect in the area of location "A" that caused a weakness that ultimately led to its failure over a cycling term.
A. **For the Keaschall configuration, yes.**
Q. Okay. Do you believe that the folds and visual indications identified by Osborne during the manufacture of the subject platform were causal to

the failure?
A. **Certainly contributing. Right up there.**
Q. And what physical evidence or analysis provides the basis for that?
A. **Well, the physical evidence in the laminate and in the x-rays of the quality of the laminate and its -- certainly its ability to carry a load in that -- in those conditions.**
Q. Again, I think we've -- we've determined that you haven't done any experiments, calculations or testing to evaluate the significance of any pre-existing delaminations in the Keaschall platform; is that correct?
A. **That's correct.**
Q. Okay. You've been provided with the details about the testing of the platforms done by Dr. Rakow?
A. **Yes.**
Q. My understanding is that they actually removed an entire area of material where you have identified these weaknesses, in your opinion, existed in the Keaschall bucket?
A. **Mm-hmm.**
Q. Is that correct? Do you agree that that's what they did?

A. **That's what they did.**
Q. Okay. Then they tested the buckets to see if they would fail?
A. **That's correct.**
Q. Would you agree that removal of all of that material would create a weakness greater than any folds, creases, delaminations that you saw in the Keaschall bucket?
A. **No. I said design intent. You didn't cover design intent. There's a tremen- -- there's totally design intent differences between the two configurations. And if you're not picking that up, you can't understand the analysis or how those buckets are put together. And that's where I'm going when I was talking from the very beginning. There's no competent design authority or intent. No design intent showing the design.**
The design intent for the Keaschall bucket was for the load to come in at the interlock area. The other ones, I have -- strongly believe the design intent was to tuck fiber into and reinforce that area. So what they did is just remove excess material from a -- the design intent from a different style of design. You want to talk -- we have to talk design intent, and we have to talk about testing or

looking at recreating the Keaschall design.

Q. Do you know whether or not the -- the change that you're talking about, the design intent, was necessary to perform for the platform to pass the newly added lanyard test in 2012 required by Altec? Do you know that or not?

A. We have -- the design intent -- you're asking for the testing, if it was valid. Now you're asking for another question. Be -- don't shift gears on me. Ask that question again.

Q. Well, you're talking about the design intent. I was talking about the testing. Let's go back and talk about the testing.

A. Thank you.

Q. My original question was, do you agree that removal of all of the area -- the material in the area that Dr. Rakow did would weaken that platform to a greater extent than the delaminations --

A. No.

Q. -- that you saw?

A. No.

Q. You don't agree with that?

A. Not for the Keaschall design.

Q. Okay. And why? What's the basis of that

opinion?

A. Because the Keaschall design is totally different internally.

Q. And -- and tell me what it is about that internal difference that leads you to your conclusion.

A. On the -- on the Keaschall bucket, if you look to -- pictures can be worth a thousand words here. Let's go to my very first report.

Q. Okay.

A. Because this hasn't changed since day one. Let's look at Figure 8.

Q. Okay.

A. What you're looking at, you see that yellowing in there?

Q. I do.

A. That's a failure plane. That's an old failure plane. Just like those failure planes that are in -- in dark brown or black on the edge. The entire structure of the bucket is resolved through that corner. There's no help on pulling material into it around the corner. There's no -- the way this is fabricated, that point, fail that location, fail that location there, and the bucket starts its catastrophic walk to failure.

Q. And how is that different than the buckets that were -- that were tested by Dr. Rakow?

A. Mr. Ra- -- if you go to Figure 9, you see a solid insert. That was premade. That was made ahead of time. You can tell that because of the lack of bonding, the smooth surfaces, the pimpling on it. That was installed in the mold as a preformed block, if you will. The material on the Rakow bucket looks like it's the same material out of the flange, and it is tucked into the rib, and it folds around the corner and provides strength of material going around the corner. And it would hold onto the side wall longer.

Now, do I understand the design intent, why somebody did this on the Ra- -- on the Keaschall style? Yes. Design intent would say, this is a much better way to handle bolted loads at the bottom where it attaches to the boom. Because when you do it the other way, and you fold the material in at the time of manufacture, you get a -- let's go to my NDE report. Second report. Let's go to Figure 14. Which is closer to the...

MR. SHIVELY: What's the date of the report you're looking at?

THE WITNESS: That would be the Appendix

A. That would be March 3rd.

MR. SHIVELY: Thank you.

Q. (By Mr. Ahl) Figure 14, you said?

A. Fourteen and 15. That would be page 11. We can use mine. You might be on the original -- you're on the consolidated report, I think.

Q. Okay. Well, here's the other one.

A. Yeah.

Q. Page what?

A. Eleven.

Q. Okay.

A. If you look to the centerline of that part, you'll see a gap. That's a weakness. And the weakness there will manifest itself when you bolt things together. And that will cause cracking and removal from service in time. Likely the reason why the -- there was a bucket removed before I got to Dawson, for that very same cracking around the bolt holes. I don't understand -- there was no criteria why they made these changes. But I can speak to how -- design intent on why they may have made these changes.

And -- but they resolve loads internally completely different. And that would have -- we would show that on an FEA. But you have to do a

proper job of modeling. You would have to nearly destroy the part. And I was unwilling to do that.

Q. You believe that it's this change that is shown in Figure 14, View 2 and 3, that -- that makes the testing that Dr. Rakow did not appropriate in trying to help us with the --

A. Failure on the Keaschall — on the Keaschall, yes, sir, I do.

Q. Okay.

A. I think it was a good — a good start. I was headed down that path myself. But when I realized that the parts were completely different, I didn't see any value in it.

Q. Did you do any calculations, testing or analysis to evaluate the significance of the difference that you've just talked about?

A. No, sir.

Q. There's one thing I want to ask you about here, I think. When you were pointing to that area in the photograph that you say is a void area? Is that what you called it on the x-ray where you said that that was?

MR. BEUCKE: On Figure 14?

MR. AHL: Yes.

Q. (By Mr. Ahl) You called that a void?

A. Yes. It is — the x-ray shows it has a cavity.

Q. Okay. And I know that you talk about that in your report of August 1st of 2016 when you're commenting on the Exponent report from Dr. Rakow --

A. Mm-hmm.

Q. -- and you indicate that the void content of the laminate is well outside standard good practice?

A. It's well outside of their own spec.

Q. Okay. What is considered standard good practice?

A. There, 24 to 28 percent based on fiber volume fraction. I was — I was — I have a hard time relating to that number myself. I was raised on the reciprocal of bulk factor of 155 to 175, would be a good number. But that's — dates me into the late '70s, early '80s as far as my composites training.

Q. Did you do any testing yourself to check out the Rakow results of his testing or just determined that they didn't apply so --

A. They wouldn't apply.

Q. Okay. Would you agree with the proposition that the removal of the material from the test buckets would have compromised the platform

structure at or about location "A"? Do you agree with that?

A. For what design?

Q. The ones that were tested by Dr. Rakow. The removal of that material.

A. For his bucket. If we're talking about his buckets, they certainly would have affected his buckets. But the — the issue there, which I didn't draw, is the crippling. He left the flange intact. He left the flange intact behind it. And that's not the way Keaschall failed, but he left his intact, which helps — let's face it. The design intent of this — these buckets are to be — what was the Altec description? A net hanging from a basketball rim.

Q. You believe leaving that flange intact invalidates all the testing that Dr. Rakow did?

A. No.

Q. Okay.

A. I said he — the reason — what invalidates his testing is he used the one part. You were asking about his part, and I was making a comment on his design.

Q. Right. And his part and the design that they used, what is it between the two of them that in your mind invalidates the results? I understand

there's a change. But tell me specifically what change it is that you're pointing to that says, that makes the results of this testing different than it otherwise would be.

A. Let me break this down and make sure that I answer your question and be responsive. The Rakor bucket — not Rakor, excuse me — Rakow bucket is internally layered. And its lamination, its composite fabrication, is completely different than the Keaschall bucket.

Q. In what way?

A. The internal rib structure of the Keaschall bucket is made with, apparently, cloth. And it's layered, pre — and it's preformed ahead of time. It's very dense. Looks very high quality. You may see that in comparing views — if we look at views in Figure 9 in the — it would be the March 3rd report to —

Q. There are two March 3rd reports, aren't there? Or are they identical? I have two.

A. No. They're identical.

Q. Okay.

A. In fact, I thought — oh, this is...

Q. Okay. What are you talking about now? Exhibit what?

A. **104. Thank you. That's the page I was actually looking for. I thought they were...**

(Exhibit No. 107 was marked for identification.)

Q. (By Mr. Ahl) Okay. Now we've marked as Exhibit 107 something that you've just pulled from your file. Why don't we identify that first. What is Exhibit No. 107?

A. **That is a picture of the bucket that we removed at -- this is a picture -- this is an x-ray of the bucket we removed from Dawson. And** Exhibit 104 is an x-ray of the Keaschall bucket. And Exhibit 107 has more in common with the Rakow design. And there's potential of there was another configuration change in here. So it's a little hard to track. And I didn't shoot the x-rays. But I'm -- of the two buckets I have, I'm looking at two drastically different configurations. And I'm looking at Rakow, looking -- Rakow's x-rays suggest -- or not suggest, indicate that he's not matching the -- the Keaschall design.

Q. Okay. And why don't you tell me what it is about the change in the design that affects the results of his test. What changes the results?

A. **It's on how the load is transmitted**

between the vertical rib and the horizontal flange. That all speaks to how -- how that is -- how that coupling is made. How that load transfer is made between those two features in the part is driven by how it's built internally. And until you get the internal configurations right, you will not get the testing or the analysis correct.

Q. Okay. And we've never tested the change in the design against the Keaschall design to determine if it has any difference on the structural integrity of the -- of the bucket; is that true?

A. **That's true.**

MR. BEUCKE: Can we identify 107 by page number and figure?

MR. AHL: Yeah. It's page number 11, Figure 14, View 2-3, looking forward.

MR. BEUCKE: Thank you.

Q. (By Mr. Ahl) That's what you were pointing to; is that correct?

A. **Mm-hmm.**

Q. Yeah. Any other criticisms of Dr. Rakow's testing or analysis or opinions or conclusions?

A. **I thought the -- I thought the analysis of the contamination was a little different.**

Q. Why don't you tell me what you mean by that? That doesn't mean anything to me.

A. **Well, you had -- you had the manufacturer of the component that couldn't identify what the contaminates were. And he put it in there. And he -- there's nothing inside the laminate that the manufacturer didn't put in there. And if the manufacturer couldn't identify it, I have -- it gives me problems.**

Q. Well, how -- how is that a criticism of Dr. Rakow or his methodology or his testing or his conclusions?

A. **Well, it was in his report. Stated as fact that they couldn't identify the contaminates.**

Q. Did you identify them?

A. **I believe, since I don't know --**

Q. Did you identify them?

A. **No.**

Q. Is it important that they be identified?

A. **I think it would be most helpful, yes.**

Q. Why didn't you do it?

A. **Because the analysis that was a joint lab was supposed to share the results, and I'm not sure that we -- well, let's just put it this way: They weren't germane to the -- to the failure, but they**

would speak to manufacturing defects or the manufacturing process.

The materials that I saw in excess in the wet chemistry, the FTR, DMA, the delaminations carried a high load of solvents, hexanes and other things. Which is not unusual for an RTM resin at that time. RTM resins carried a high load of solvents so they could move them. But it also indicates that the solvents were never bumped from the mold. And that would indicate that the process might not have been adequately addressing solvent removal during the cure-up phase. And I thought it was interesting, but -- and one of the things I, you know, commented on in manufacturing. It spoke to care during the manufacturing process.

Q. No one told you you couldn't try and identify those contaminants, did they?

A. **No.**

Q. Okay. Any other testing, calculations, or analysis that you have done in regard to your investigation of this incident that we haven't talked about here today?

A. **Well, we have the rest of the body. You have the thermo analysis that we -- that they looked at. And the other -- you know, the other testing**

that was provided. Laboratory work. Interpretation of that.

Q. I guess what I'm more interested in is what you've done. Not what has been done as a joint effort. Everything that you've done. Any testing, analysis, calculations?

A. No. You have it all.

Q. Okay. Do you intend on doing anything else?

A. That would be -- there are some things one can do for thought experience, but, no, not right now.

Q. I'm assuming that you're charging the plaintiffs for your time in doing your -- your investigation and your analysis?

A. I've kept track of my log, which I've supplied. I have not invoiced any time.

Q. Okay. What is your hourly charge?

A. 325 an hour.

Q. Okay. Do you have any rough estimation as to how many hours you've put into this project so far?

A. Gosh. I never even totalled it out. I'm sorry. It's on my logs. I just made sure my logs were accurate.

Q. Okay.

A. We'd have to look at it.

Q. Do you have a normal billing procedure that you bill monthly, quarterly, semi-annually, anything?

A. I'm to the point where, you know, I'll bill when I -- you know, when I find the time, sir. It's not important to me right now.

Q. That was going to be my next question. Is there any reason you haven't billed this?

A. No.

Q. Okay.

A. No.

Q. Your bill isn't -- isn't determined by the outcome --

A. No.

Q. -- of this case?

A. No, sir.

Q. Okay.

A. No, no, no. There's no arrangement there.

Q. Okay.

A. No. None at all. It's me being independent-minded, sir.

MR. AHL: Okay. Why don't we take about

five minutes, and I think I'm just about done.

(At this time a brief recess was taken.)

Q. (By Mr. Ahl) I just have a couple more questions, then I'm done, and I'm going to let Mr. Shively ask you a few. During your examination, you referred to another bucket that you took out of service from Dawson Power.

A. Yes, sir.

Q. Where is that bucket?

A. I believe it's in storage here in Lincoln.

Q. Okay. Did you ever determine what the year of manufacture for that bucket was?

A. It was after this one.

Q. Do you know when?

A. Yes. It's in my reports. It's not something I have in -- it's on the NDE report, I believe. The serial number and the...

Q. Did you perform x-rays on it?

A. Oh, absolutely. That was the comparison.

Q. Okay. And did you determine that that one had a different design, in your opinion, than the Keaschall bucket?

A. Yes, sir.

Q. Other than the x-raying, was anything else done with that bucket in terms of testing or analysis?

A. Well, sir, the -- when I went to Dawson and I saw the bucket, it gave me concerns to -- to my eye, my trained eye. And so I asked to have it removed from service. And it was brought to Lincoln, and that bucket I was planning on destructively going through and doing a lot of things to do those things that would have been appropriate. And it ended up being not worth the time.

Q. So other than the x-raying, there was no other testing or analysis done on that bucket?

A. We had some cursory black mic studies. If you look through, those are documented. What I was looking for, extent of contamination. Sometimes oils, hydraulic oils, have tracements in them, and you can see how far they track into a laminate. There are -- there are tricks of the trade there that you can -- you can use. But no. They -- they went to storage.

Q. Did you ever have an opportunity to actually view the truck and the boom that was involved in this incident?

A. No. I looked at one similar, sir.

Q. Would it have been helpful for you to see the boom where the separation took place or not really?

A. I looked at the parts. If you can, my charter starts at the -- at the bolt holes of the composite. So looking at those, you know, the piece that stayed with the boom I had in front of me. And so, therefore, we worked really hard with those pieces, those parts.

Q. So there would have been nothing that would have been helpful to you to have the actual boom or truck --

A. Right.

Q. -- available for your analysis?

A. Right. And that goes to, you know, I'm not a lineman, sir. But I am an expert in composites.

Q. Okay. Any other buckets that you -- or platforms that you have had for your review or analysis other than what was done with the Keaschall bucket and then this second bucket that was taken out of service?

A. No. Just these two.

MR. AHL: I think that's all the questions I have for you, then. I'll let Mr. Shively

have a go.

CROSS-EXAMINATION

BY MR. SHIVELY:

Q. First of all, I just want to make sure that I'm up to date on everything that's happened either in recent weeks and months and since your deposition was originally taken in October. And so with regard to your CV that you submitted in this case, are there any changes or updates to that since that time that you can think of?

A. I'm on a lot of international committees. The last one was yesterday morning I was reviewing the results of HyPactor, which is impact damage to composite parts and pre-normative research for regulatory controls for international standards.

Q. Does that include fiber composites?

A. Yes. That's its only concern.

Q. Anything else you can think of?

A. No. It's -- like I said, it's -- no.

Q. When Mr. Ahl was questioning you at your first gathering of your deposition, you indicated this was the only case you had in which you're serving as an expert witness?

A. That's correct.

Q. Is that still the case?

A. Yes, sir.

Q. With regard to fall protection, you testimony -- you testified on direct examination about a number of things. I just want to make sure I'm following your testimony. You talked about the difference in the length of the lanyard, I believe; is that correct?

A. That's correct.

Q. And I believe you used the difference between six feet and four feet?

A. His was -- his lanyard was, I believe, over six feet. I don't know the number.

Q. And then at some point in time, are you aware of a change that was made to that fall protection system?

A. There was a change made to the anchor point.

Q. Okay. And that was well after anything was manufactured in connection with this bucket and lift system?

A. Right. Well, your words, sir. I would have to check, sir.

Q. Okay. Well, were you aware of a PUN change in 2013 to the length of the lanyard?

A. I was aware of a change, yes. It was in

the -- Altec made reference to it. And when I looked at it, I went to the OSHA regulations. And they were talking about the -- why that came about, or the OSHA -- I was interested to know the why.

Q. Well, with regard to the length of the lanyard at the time of this incident, do you have any opinions as to any problems caused by that length?

A. Well, the rationale for changing the length of the lanyard, as I understand it in the OSHA, okay, and I'm speaking of having reviewed it, sir, was that you don't want to cause more hazard using the lanyard than not. And typical indications of that would be fall back into -- swing back or swing through or drop into hazards. Okay? And that's why OSHA dictated for, I think, for lift trucks, fairly short attachments. Which makes operational sense to me, that if you're hanging up in the air, you've got half a chance of getting controls. But there should be somebody down below anyway. But you can reach the controls with a short lanyard.

Q. Well, do you have --

A. This lanyard was -- this lanyard that he was using exceeded that.

Q. Exceeded what?

A. His -- the short lanyard. He had the older style long lanyard, which would have been legal because he had no structure under him. OSHA would have been fine with the long lanyard because he had nothing under him that he could fall into or through or swing into that would cause more hazard than not using the lanyard.

Q. In other words, at the time of this incident, did the fall protection system in place violate any ANSI standards or OSHA standards or any other standards you're aware of?

A. No, sir, it did not.

Q. Are you aware of any reason that the safety harness could not have been attached to the D-ring on the lanyard attachment?

A. No, sir. That would be subjective on that point, sir.

Q. Do you have any knowledge of whether that D-ring to which the lanyard could have been attached remained at the boom?

A. Well, there's pictures of it remained, that it was on the boom. That's an objective fact.

Q. You also talked with Mr. Ahl about the timing involved in the failure of this platform. And do you believe there was a hesitation in the failure?

A. Yes.

Q. And could you describe that for me?

A. Okay. Again, this hasn't changed from the first time I wrote it, other than I've picked up more and more refinements in the clues. As I envision it, as I -- as I personally reconstruct the accident at the start, but then go shift to what bears objectively shown in the composite, I believe that based on the positioning and what he was doing, he was on the far outside corner standing. All right? I believe that he probably heaved on something that exceeded his weight with his upper body strength. Gave a push, pull, or whatever. That triggered the cascade.

He wouldn't have known about that. There would have been no visual indication or inspectable thing from Altec on -- that he was flying a crippled part. Maybe an experienced composite engineer would have picked out there was a problem there, but him as a user might not have. Or didn't. Actually didn't.

Anyway, the very first thing would have been the failure location at "A." There would have been a pop and a snap. A pretty good report. Because there was a lot of energy in the bucket at that point. All right? And that would have been a

pretty good bang. And what's happening at that point now -- and, understand, we're talking on relative time scales. I'm not putting any absolute numbers on here.

I'm talking about time scales within how things are moving in the laminate, is "A" failed and rotated up and over. The part came up and over and tore. There was a torsional tear. It came -- it sheared, a torsional tear and broke free. As it broke free, a fracture plane developed almost parallel to the inside surface of the bucket. And it started to rip down. As the bucket lowered under his weight, started down moving, that fracture plane would have rolled up, starting in the corner.

As that -- now, I'm going to shift ends. I'm going to go -- now I'm standing where he is looking to what he would -- if he turned around and looked, he would have saw the fracture coming up the backside. And the "B" location now is taking the load. As the bucket is moving down, it's taking more and more and more of the load. In fact, it's -- it failed by torsion. It literally tore apart. It separated in a torsion and came apart top to bottom. It would have sounded -- that would have sounded much like a limb in an ice storm, a tree limb breaking and

twisting, how you get a crack and a twist and then breaks, and then it -- you hear them twist out. This is similar to the same type of noise you would have heard.

As "B" was failing, another crack would have propagated out -- or the crack propagated out from "B" location and went out into the "V." If you look on the -- the side of the failure plane, that's -- it's tearing the -- the bucket is tearing away from the corner. All right? So now we have the bucket moving down. The question is, was there hesitation? Did "B" hang on long enough, or did it just continue to move through? That's become subjective at that part.

But we know the bucket -- the floor of the bucket was in motion. It was coming down. When "B" failed, either -- the failure at the "B" location is witnessed at the V-notch. Because now the V-notch -- all of the sudden the fracture -- instead of the fracture running that direction around, it reverses. And the face of the fracture changes now from the -- it changes sides because of side. At that point the fracture races down now to the most stiffest, strongest part of the bucket remaining, which is the corner. You know, it's a reinforced

corner. And it came up.

And at that point when those met, what happens now, instead of having vertical fracture planes, we have a horizontal fracture plane, which means that that corner was essentially bending, snapped, just like that. And that gave me -- if you look, that aligns in that exit cone. It's very hard to say what direction it exited in, but you can put a cone, an error cone, in it. Because it all depends on how long "B" held on, is dead center of the impact point on the truck.

And that was one of my points of my original analysis, that the -- the evidence in the composite says it hinged here and broke free and exited in that direction. My problem is, I couldn't point it into a direction. And I never attempted. That's something that Railsback did. That's what I said. I liked his analysis there. Now, how much energy? At the point of separation --

MR. BEUCKE: I think you've answered his question.

THE WITNESS: Okay.

Q. (By Mr. Shively) You've talked of two sounds. You talked of a loud sound or noise when the fracture began at point "A." Am I correct?

A. **Yes.**

Q. And then there was a second sound. Was that when "B" was starting to go?

A. **Yes.**

Q. Would those sounds be loud enough that the operator would be able to hear them?

A. **Oh, yeah.**

Q. Do you have any opinion on the amount of time involved from the time the failure began at "A" and then through its hesitation and its other failing that you've talked about?

A. **It depends on the strength of "B," how long "B" held in. Knowing -- seeing how "B" failed and how it was being ripped apart, it was failing somewhat slower. And I say somewhat, being hard to quantitize. And that's why I said, it could have been -- he could have had anywhere from an oh, gosh to a heartbeat. Between those two events happening.**

Q. And I -- I believe that you testified earlier that you thought the time between the two sounds was less than a second?

A. **Yeah.**

Q. Is that correct?

A. **Like I said, an oh, gosh. It could have been shorter.**

Q. And what I'm asking now isn't the time between the two sounds, but the time from the first sound, the beginning of the failure, to the time the platform detached from the boom.

A. **Oh. Maybe another half second, second. Certainly not inside of a thought process.**

Q. In terms of the possibilities or a range of how long "B" hung on, can you quantify that at all for us? Less than five seconds? Between one and four?

A. **Oh, I think it was less than -- "B" probably hung on for less than a second.**

Q. Could it have been up to two seconds from the time the first sound happened and the time the platform detached from the boom?

A. **About a two count. Yeah, that'd be about right.**

Q. In fact, you wondered if there was any chance that the operator reached out and tried to grab at something?

A. **I didn't wonder that. I suggested that he may have had, depending on how -- what his thought processes were. Okay?**

Q. Well, one of your thought processes, he would have -- could have yelled, oh, no?

A. **Yes. Or, you know, oh, "S" or, yeah, any number of very short...**

Q. Could have also reached out, tried to grab something?

A. **Yeah.**

Q. And, in fact --

A. **But if his hands were full.**

Q. -- you wondered if there were any injuries to his hands that would show that. Am I correct?

A. **Yeah. If he -- if he came first, yes.**

Q. Did you ever find any information out about that?

A. **I explicitly did not want to be involved in any medical.**

Q. Although I have a copy of an e-mail from you of April 18th, 2015, in which you say, to support the engineering analysis it would be interesting but not critical to find out if there were hand injuries on the victim that would be consistent with any panicked attempt to grab something?

A. **Right. That would be -- I think I was writing to Steve, and I was suggesting another expert might be warranted.**

Q. And that hand injuries indicating a

panicked attempt to grab something would back up the rate of failure in the composite as the ability of the human to recognize and respond to danger can be estimated with reasonably accurate limits. Did you do anything to follow up on that?

A. **No.**

Q. But he -- potentially the operator had some time to do something?

A. **I don't know. I didn't see any -- there was no -- no return on the -- on that e-mail if there was --**

Q. But it would be reasonable that they would have time to verbalize an oh-no moment; correct?

A. **Yeah.**

Q. Yes?

A. **Yeah. It would have been reasonable. Or shorter.**

Q. And during this potentially two-second timeframe could have been moving the boom and operating the -- the unit?

MR. BEUCKE: Let me object to the question insofar as it asks the witness to speculate.

Q. (By Mr. Shively) Go ahead.

A. **If we're speculating, I would rather**

speculate that he was using his wrench taking the nut -- nut loose. I would think that would be a better speculation. That he was working where he should have been, taking the nut loose.

Q. Assuming he was operating the boom itself, there's no reason that he couldn't have continued to operate it during this two -- potentially two-second timeframe?

A. **Speculation.**

Q. That's fine.

A. **But it depends on where you believe his hands were. I -- obviously, when he -- the bucket did not fail when he crawled into it. Close, but it did not fail. So that says what caused it to fail when he crawled into it is, is I'm looking for another causative effect of, he's working. He's using upper body strength. He's probably putting double his weight on whatever he's doing out there over the edge.**

Q. You told me a while ago that he -- he may have heaved on something. Those were your words, heaved on something?

A. **Mm-hmm.**

Q. Yes?

A. **Yes.**

Q. What does that mean? What would be the something that he heaves on?

A. **Those are very big nuts that he was removing on those -- on that pole, that transformer. It's not farfetched to believe, having handled large tools like that, that he sat and maybe locked a socket up on it and had to break it loose and give it a good yank, good pull, something that required a significant part of his upper body strength to multiply the load.**

Q. What is a resin area shrinkage analysis?

A. **What you do is -- it's very straightforward. You have a distance, and you -- your composite, you fill it with composite and you cure it. And you'll get a gap. And the gap, you do a ratio of the -- of the gap -- of the distance that you filled and the gap that was created, and you get an estimate of how much shrinkage your process is providing you and control that you're giving on -- on a process.**

Q. Did you ever do a resin area shrinkage analysis on the platform in question?

A. **Did I put a ruler on those pictures? No. Didn't need to. There was a large gap there. Normally you do that to make sure -- normally those**

analyses are done to validate your process constraints between good parts. You have a good part that you know is good, and then you change a process parameter and validate that you're getting -- you're within reason.

Q. Did you do one on the platform that was removed from service at Dawson?

A. **No.**

Q. And did you do one on any other platforms that you had access to?

A. **No. Not platforms.**

Q. At some point did you feel that doing such an analysis was indicated?

A. **For the design authority, yes. A little bit late after the fact, sir.**

Q. Was there ever anything that you requested be done in terms of testing, experiments that you were not authorized to do by those who hired you?

A. **Oh, no. I had full access.**

Q. And that would include contracting out with any third party?

A. **Absolutely. That was not an issue.**

Q. So some of the things that you at points in time were considering doing, you ultimately

decided just wouldn't — didn't need to be done. Am I correct?

A. I — yes. Absolutely.

Q. As opposed to I really wanted this done, but I wasn't allowed to do it?

A. No, sir.

Q. Okay. Did you consider having any third party or contracted entity analyze the -- evaluate the contaminates?

A. The contaminates, we were given results of the FTIRs from a macro viewpoint. Okay? The contaminates were either from the environment or in situ, they were there at the time of manufacture. Looking at the contaminates at the time of manufacture, those that were enclosed in cavities, they're consistent with — in my experience they're consistent with the manufacturing process that didn't vent them.

Q. Do you have any opinions that there were any manufacturing defects on any manufacturing performed by Altec?

A. Well, did Altec machine it?

Q. I'm asking you.

A. Well, no. It's a serious question. I mean, there was -- like I said, I — I have no idea

who — who had the design authority. I had no idea. There's nothing in Altec receiving what they received. There's nothing that said this bucket was received in this condition and it met spec. Which is a violation of ISO 9000 in all regards. I mean, there's some very basic things in risk management in those surveys. And so if Altec simply received the part, then they didn't manufacture it. The question is, what did they — did they have any follow on operations. I don't know.

Q. With regard to the design of the platform, of the Keaschall platform, are you aware of any ANSI standard that was violated?

A. No.

Q. And I heard you earlier when Mr. Ahl was questioning you express the idea that you think the ANSI standards may not be how you would write them or be -- be that great. Is that a fair summary?

A. I don't know if it's a fair summary. I think we need to be very careful and very cautious in the words here.

Q. Well, I'm just trying to distinguish between whether -- whatever the standard was, regardless of what you think of that standard, did -- are you aware of any --

A. I have checked — let me put it this way. I pulled the -- ANSI is the registrar. In fact, they're our national registrar internationally. And I'm a credited delegate within ANSI. The secretariat for A92 is SAIA. The -- it's an acronym for whatever it is. They're the secretariat. I notice that there are many — you know, I checked the people that were in the committee.

I would like to have time to pull down the meeting of the records of the A92 committee since 1992 on what composite issues they addressed. Because I have known that in other ANSI standards and other international standards, we have run across many issues and addressed many issues of design and testing in advanced composite products that I do not see in this standard. And so in that regard, I would have liked to review those meeting minutes.

Q. Do you have any evidence at all that ANSI A92 was violated in the design of this platform?

A. No. As it's — as it was published. Let me be very clear on that. As it was published.

Q. Are you aware of any standard of a governmental agency or a professional engineering society or association that was violated in the design of this platform?

A. All right. Here — here this goes back to ANSI, several years back, A92, the secretariat refused to upgrade — to be in conformance with the international ISO standards for mobile lift platforms. I — the number is in my files. You'll find them. The international standards are quite — structured quite different. That's okay. The U.S. delegations defer to — or are different than the Europeans at times. But it's interesting to note that ANSI now has dictated that A92 will be in compliance with ISO standards in the next publication.

And so what I'm saying is, I don't know, but there seems to be a great deal of work going on right now. Again, I forget, there's 36 — ISO 3649 -- there are three separate standards that are broken out in international standards.

Q. Does that apply here?

A. They are mobile lift. If you were going to — if you're going to use this truck in Europe, you would be meeting those standards.

Q. Never mind.

A. Well, no. Okay.

Q. Yeah. I'm not even going to have her read the question back. No. I'm done with that

question, and I think you're done with your answer, to the extent it was an answer.

Back to the fall protection, you talked about the -- being tethered to the lanyard and in conjunction with a guillotine. I just want to make sure I'm understanding what you're talking about there.

A. **Sure. Let's see if we can get a picture. Let's look to my original report, September 26th, page 20, Figure 15. What you're looking at is the boom in proximity to the pole. What I asked myself or I started looking at, what would happen if Mr. Keaschall would have had his fall protection on? And given the length of his lanyard, he would have been somewhere shoulder high or head high on that sharp edge.**

Q. What sharp edge?

A. **The bottom of this. On that edge.**

Q. You're talking about the bottom of the remaining structure?

A. **Right. Because he -- he belays off the -- the lanyard -- or the anchor point. And when you lay that -- lay that length down, where does he end up? Where does he physically end up? And that speaks to the idea of the OSHA requirements of length**

of lanyard. And that's why I was asking, if you're saying the four-foot version of the lanyard that Altec would have said should have been used, the short one, I would have said no. That would have put you right into that very sharp edge. And drug you through it. The longer one, he was fine.

Bear in mind, he's coming through that. I think it's -- when you start talking about him actually being drug through that edge -- and he would have been drug through that edge, because we know the bucket went sideways. However theory you apply, he would have been pushed down and under that edge and held there by that lanyard. The question is, is would you do that? Would you pick that for yourself?

Q. So that's a subjective criteria rather than following the actual rules of your employer?

A. **That would be a subjective. I said that earlier. Very clear on that.**

Q. So if the employee deems it's okay to violate a safety rule of a company, then they should have the discretion to do that?

A. **No. That's not what I said.**

Q. Okay. Again, just so I'm clear, that fall protection system complied with any OSHA standard at the time?

A. **The fall protection was compliant in that it envisioned the bucket staying on the boom. With the piece of the bucket separating from the boom, maybe another expert may want to take a look at that and say we were compliant or not. Certainly the short one riding under that...**

Q. But that wasn't the standard at the time, the shorter lanyard that you're talking about?

A. **Well, it was the standard when -- during the accident, I believe. I'd have to check.**

Q. Except for that PUN was 2013, and the accident happened in 2012. Do you have any argument with that?

A. **No.**

Q. Okay.

A. **I -- sorry.**

Q. And to whether there was any other clear back to the date of manufacture?

A. **The idea here is that the fall protection lanyard should not cause more -- should not cause more hazard than its use.**

Q. Do you have an opinion here that that did -- that it would? Is that your professional opinion?

A. **My professional opinion is that it's not**

clear that it didn't.

Q. Referring to your report of September 26th, 2015, page 3.

A. **What was the date again?**

Q. Your September 15 -- or 26th, 2015.

A. **Thank you. Page 3. Got it.**

Q. And that's where you list 11 different opinions.

A. **Yes. Summaries.**

Q. And I want to talk about the summary 11, because I don't understand it. In lay -- a layperson's terms, can you tell me what that says?

A. **Do you know what ripstop -- ripstop cloth is?**

Q. I'd rather you tell me.

A. **Ripstop cloth is when it gets cut, it has enough strength or reinforcement to contain the rip. It does not continue to tear. Much like plastic wrap, you cut a plastic wrap, and it continues to run and roll. That's the type of failure short strand composite has. And it has that because it must rely on the resin for its strength. It is a resin -- what we experts call a resin-dominated strain field, or resin-dominated strength field. You are only as strong as your resin. You have to manage the resin**

for its long-term characteristics. If the resin -- if will not stop a crack once it's running. If you're going to stop a crack, you need long fiber reinforcements.

You're asking for, and I think the analogy I used earlier is, short fiber has the consistency of dryer lint, is the best way I can tell you what it's like. And you're pouring epoxy resin into it, and you're making something hard. Now, it's normally used as coring materials. You don't find it in primary structure. And, in fact, if you go look at handbooks, no handbook lists this material or the use of this material in primary structure. I had to look really deep in my own files to find even papers that would even provide strengths. Certainly not anything with long-term fatigue and cycle resistance. Lots of data on long fiber. Hardly anything on short fiber.

Q. What do you mean by short fiber, random mat was improperly applied in the design?

A. **You're carrying your primary structure. If "B" would have been -- if you would have had a cloth or continuous fiber in the flange, there's a good chance he'd be alive today. This is -- this is -- this material was improperly applied, and I**

think that's -- okay. My opinion.

Q. As we morph between design and manufacture, that's what I'm trying to understand. Is the lack of material in the flange a design issue from your standpoint or an issue that was done at the time the platform was manufactured?

A. **You're speaking to design intent. Using of this -- use of this short fiber, random material in primary structure, especially primary structure that's life-critical, is a design flaw. Couple that with manufacturing techniques or whatever later just adds to it.**

Q. In number 11, do you talk of both, design and manufacturing? I'm trying to understand your engineering language.

A. **Yes. But primarily in -- in 11, it's a design consideration. It's something up front. If I was going to a design handbook, this is not the material you'd pick, is the best way to put that answer, sir.**

Q. With regard to that same report of September 26th, could you turn to page 6, please?

A. **Yes, sir.**

Q. Number 6 you indicate that you reviewed depositions as provided by the client. Could you

tell me what those depositions were?

A. **Those would be all of the records that I had to sign under court order for.**

Q. Well, as of the date of your report, September 26th, 2015, do you have any recollection of what depositions you were provided to review?

A. **It was the entire -- all of the -- okay. Let's be explicit. What number are you asking for?**

Q. That's my point. Number 6, depositions. As of the time you wrote this report, I'm interested in knowing what depositions you had reviewed.

A. **Oh, I had all of them that -- all of them that had -- were given to me that were taken before this date, September 26th.**

Q. Is there any way to know what those were?

A. **Yeah. They're in my files.**

Q. The actual deposition transcript --

A. **Yes.**

Q. -- would be in your file?

A. **Yes. In fact, if you look -- some of the key ones I had printed out, and you can -- I had them numbered, where I was numbering and taking notes on the different depositions.**

Q. What you're showing me now isn't a deposition. Do you know what a deposition is?

A. **Let me see. Yeah. Is that not a deposition?**

Q. No, sir.

A. **Okay. Then I'm not a lawyer. Question and answer. I thought a deposition was a question and answer, sir.**

Q. That's what we're doing here today.

A. **Okay.**

Q. And after what we're doing here today, the court reporter types it up. And I was just trying to find out what you looked at before you came to your opinions in regard to transcripts of actual depositions which were taken under oath in front of a court reporter.

A. **Yeah. And I -- those -- we had those from -- that were all in the package that I signed for under court order.**

Q. So you believe any deposition transcript that you reviewed would be in your file that you provided us prior to today?

A. **Absolutely.**

Q. Thank you.

A. **Thank you. A roundabout way, yes, sir.**

Q. Have you reviewed any deposition transcripts subsequent to preparing this report?

A. No.
Q. If you could look at your report of August 1, 2016, and I'm referring to Figure 12, page 11 -- page 13.
A. Here it is. It's under that report. What figure?
Q. Figure 12 on page 13.
A. Okay.
Q. There you go.
A. Thank you.
Q. I'm just trying to get a scale of this. What size of actual material is this figure depicting?
A. Oh, extremely small. The diameter of fiber is -- well, if you wanted, we could scale off the diameter of the fiber. I'd have to check it. But that's a very -- that's a small scale.
Q. In terms of millimeters, can you do any better than very small?
A. That's probably less than a quarter of a millimeter. Or, actually, probably finer than that. That might be a tenth of a millimeter. Fractional. Obviously it's looking under a microscope, sir.
MR. SHIVELY: I don't have any other questions.

MR. AHL: I have about two after you guys finish up.
MR. BEUCKE: I'll ask a few so you don't grouse at me for going back and forth.
MR. AHL: We've established, that's okay.
MR. BEUCKE: Not with you, apparently.
MR. AHL: It had to be. Otherwise I would have --
MR. SHIVELY: I didn't say a word.

CROSS-EXAMINATION

BY MR. BEUCKE:
Q. Okay. Just a few clarification questions, Mr. Eihusen. You mentioned ISO 9000 several times. Are those standards?
A. Yes. They are internationally recognized standards on managing risk in the design and manufacturing process.
Q. Do you have any -- do you have an opinion as to whether those standards were violated in this case?
A. There was a request to produce materials relating to the bucket. Those standards would have required significant files to be generated during the design process, during the fabrication process, during the development process in both companies to

manage the risk of the product development. The fact that they're not there, I don't know if that's an oversight or it wasn't done. But certainly not having it is a violation.
Q. You were asked about your utilization of any outside consultants in this matter. You did use an outside consultant to perform the x-rays, did you not?
A. Yes. You have to be -- to use -- you have to be licensed. And to handle the sources, you have to be -- it takes a, what I would call, tech level skill to do the setup and generate the shots. But at that point, the interpretation was up to me at an engineering level. Something I do.
Q. In your September 26th, 2015, report, reference page 4 for me, if you will.
A. Yes, sir.
Q. You responded on page 4 to question of interest 1 and question of interest 2, have you not?
A. Yes.
Q. It appears that your response to each question references the manufacturing and design processes. Is that a fair statement?
A. Well, yes. And because that's the first step of the evaluation.

Q. Your opinion -- as to question 1, your opinion as to whether defendants used reasonable care in the manufacture of the bucket, was a basis for your opinion also your examination of the photographs, the actual bucket, and documentation relating to the bucket?
A. Yes. As previously said.
Q. As far as question number 2, your opinion as to whether defendants used reasonable care in the design of the bucket, was that also a basis for that opinion, your examination of the photographs, the bucket, and documentation related to the bucket?
A. Yes.
Q. These two opinions that you gave as to questions number 1 and number 2, the basis for those opinions is not solely based on a lack of information provided to you, is it?
A. No. We were -- as in section -- on the summary points, those were generated in looking at everything in total.
Q. And that's as you previously testified to in this deposition?
A. That's correct.
MR. BEUCKE: That's all I have.
MR. GUENZEL: I have just a couple of

questions, Mr. Eihusen.

CROSS-EXAMINATION

BY MR. GUENZEL:

Q. In addition to hiring an outside company to do the x-rays, have you also used the services of a -- of a professional photographer --

A. **Yes.**

Q. -- Kevin Binder? And, now, your report that was written in September of 2015 was done months before the joint inspections that were done in California in the spring of this year. Is that fair to say?

A. **Yes.**

Q. Having completed the joint inspection and examination that was done in California this spring, did some of the results of that work also support your answers to questions 1 and 2 on page 4 of your September 2015 report?

MR. AHL: I'll object to the form of the question. There's no reasonable -- no proper and sufficient foundation. Go ahead.

Q. (By Mr. Guenzel) Such as the -- the electron microscope photographs, the --

A. **Oh, did I use them on -- on the -- yes.**

Q. I mean, do some of the observations you

made in California and do the results of the work that was done in California support your opinion -- your answers to questions 1 and 2?

A. **Yes. In fact, I never changed those from the first time I wrote them. They were based on the evidence contained in the composite, the bucket, and the documentation provided.**

Q. And you were asked some questions by Mr. Ahl with regard to testing as being a key in the scientific method. Are -- are observations also used by scientists in -- in developing opinions?

A. **Absolutely. In fact, many -- many inspection criterias for the safe use of composite hardware are based on visual inspection techniques. There are many ISO standards and many standards that we could quote that visual inspection is the primary and valid way of inspecting composite material.**

Q. And after this bucket itself failed, is there any way to test its strength after the failure?

A. **Not as a unit.**

MR. GUENZEL: No other questions.

MR. AHL: After those questions, I'm not sure which of the three I've got to ask additional questions to, but I'll start with you. Just teasing. Just teasing.

MR. BEUCKE: I would say I've heard worse this morning, but I didn't see my wife this morning.

MR. AHL: Shively wasn't that bad.

(Exhibit No. 108 was marked for identification.)

REDIRECT EXAMINATION

BY MR. AHL:

Q. Let me show you what's now been marked by the court reporter as Exhibit No. 108 and ask you if you've ever seen that photograph before?

A. **Yes.**

Q. And can you identify that for us, what that purports to show?

A. **You're looking at the accident location apparently shortly after the body of Mr. Keaschall had been recovered.**

Q. Do you understand that was taken by the authorities who were investigating the incident?

A. **When you say authorities, I'm assuming the sheriff's office.**

Q. That's who I would assume as well.

A. **But there were many pictures of the location, so I wanted to make -- clarify which it was one of.**

Q. That's the way I understand it. Do you

accept the positioning of all of the different components and items of property that were involved in this incident as reflected in Exhibit No. 108? Do you believe that that's how it actually looked? Or do you think it's different?

A. **I think that, to be fair, sir, I would have to make -- one would have to comb the depositions a little closer to make sure nothing had been moved in the recovery of Mr. Keaschall. That would give me pause. But, yeah, there's photographic evidence the way it is. But to ensure that beyond a reasonable doubt, you would re- -- look at the -- the depositions on what was done. I mean, there was first aid applied. There was people moving around.**

Q. You accept that that's where the pole was?

A. **Yes.**

Q. You accept that's where the truck was?

A. **Yes.**

Q. You accept that that's the location where the bucket came to rest after the incident, or you don't know that?

A. **We don't know that. We know the truck wasn't moved by Mr. Keaschall. We know the pole wasn't moved by Mr. Keaschall. The bucket...**

Q. I'm going to ask you some questions about that in just a minute. And when I do, I want you to assume that that bucket is in its final resting position after the incident --
A. **Okay.**
Q. -- and no one moved it. Okay?
A. **Okay.**
Q. First of all, I want to go back. Mr. Shively was asking you some questions, and you were explaining the failure sequence. And you made a statement about there being energy in the bucket at the time of failure. Do you remember saying that?
A. **I was saying that there was rotational energy and rotational momentum before final separation. In fact, it was moving. Yes.**
Q. Okay. That energy that was in the bucket at the time of the failure, where did that come from?
A. **That came from the moment arm, of it swinging down.**
Q. What was producing the energy, though? Was it the load in the bucket?
A. **Yeah. The bucket itself, the load, everything else. It essentially -- like I said, it's a pendulum on a string.**
Q. And you agree for that bucket to move

from its position on the boom at the time of the failure either downward or laterally, there had to be some energy that was providing that movement?
A. **Yeah. But if you go back to Mr. Railsback's picture looking down on the bucket, that distance from where this outside edge to the truck is a lot closer than -- than this view gives you credit for. You might want to take a look at that one.**
Q. Yeah. And I'm just asking you whether you agree with that proposition. For the bucket to move in any direction after separation, there had to be energy to provide that movement. Do you agree with that from an engineering perspective?
A. **Yes.**
Q. Okay. And I think that you were talking about Mr. Keaschall performing some activity that may have increased the load in the bucket or produced a greater amount of energy at the time of failure; correct?
A. **Mm-hmm.**
Q. And you were, I think, speculating that it might be his use of a wrench and trying to loosen a nut that may be stuck?
A. **It was a multiplying force that's**

something he could develop.
Q. Okay. What is that hanging from the bucket?
A. **That's an impact wrench.**
Q. Okay. And how does an impact wrench work?
A. **It turns a nut.**
Q. Do you use manual force to do that, or do you press a button and it uses either compressed air or electricity?
A. **For every action, there's an equal reaction. That wrench --**
Q. Do you know how that wrench works?
A. **Yes, I do.**
Q. Is that -- have I described it correctly, that it -- that the -- the ratchet or the wrench will spin either through the application of compressed air or electricity?
A. **That's -- it would spin.**
Q. Okay. And do you use manual force like you do on a regular ratchet to loosen a nut?
A. **The same force that you apply in a manual wrench shows up in your wrist on that impact.**
Q. Okay. Do you use the same bodily force using an impact wrench as you would if you were using

just a regular wrench with no assistance either through electricity or air?
A. **That's why people use it, because it goes easier. Because the impact hammers it. But the engineering fact is, you hold onto the wrench. You transfer the load to whatever you're standing on. And if you bind the socket, which is a lot of time happening -- we're talking conjecture here. I -- it's not -- it's very easy to bind sockets and have to pull it, break it loose.**
Q. Okay. That's an impact wrench, though, isn't it?
A. **That's correct.**
Q. And it would work through the application of what? Do we know whether it's electricity or air?
A. **I would think for this application it would be air.**
Q. And, again, looking at Exhibit No. 108, I asked you about the movement of the bucket after failure to move laterally a distance to strike the back of the truck. Do you remember those questions?
A. **Mm-hmm.**
Q. And do you see the railing on the back of the truck where --
A. **Mm-hmm.**

Q. -- the bucket hit?
A. **Mm-hmm, I do.**
Q. Okay. Do you accept that that's where the bucket hit?
A. **It hit the truck there, yes.**
Q. And it bent that railing, didn't it?
A. **That's correct.**
Q. And it would take -- took a sufficient velocity or force to cause that fiberglass to put a bend in that steel -- steel railing, wouldn't it?
A. **Yes, sir, it would.**
Q. And it left a mark on the bucket, too, didn't it?
A. **That's correct.**
Q. And you were trying to give me a second scenario where you thought that the bucket might have fallen down, struck the ground, bounced up, hit the railing and did the damage. Is that -- is that your scenario that you were talking about earlier?
A. **I said, I agree with it hitting the truck. But, to be clear, and to be objective, there is -- I have seen large composite parts absorb energy and bounce. I have appreciation for this thing could have come up six, eight feet in the air if it would have hit the ground.**

Q. And do you believe it would have then come down with enough force to bend that steel railing after bouncing off the ground up six or seven feet?
A. **It's 800 to 1,000 pounds. On edge, a lot of things can happen, sir. But I will say, I agree with the first -- likely the first impact is to the truck. But that's not objective evidence. There's no objective way to know that, is what I was saying to you, clearly.**
Q. Based upon the application of engineering principles and knowing what the effect on the materials was, applying the standard within a reasonable degree of engineering certainty, would you agree that that bucket, after it separated from the boom, struck the truck before ever striking the ground? Do you agree with that based on a reasonable degree of engineering principles and certainty?
A. **Reasonable, yes. To a reasonable degree. And I was -- made that clear. Yes, it's reasonable. But I was giving you clarity that there are some things here that are objectively true and some of them that are subjectively reasonable.**
Q. If I understood your answer to Mr. Shively's question, it was the energy or the load

in the bucket ultimately right before the failure that you believe caused the end result of the failure?
A. **We're confusing here. You're talking about energy in motion.**
Q. Well, let's just talk about the load, then.
A. **Okay.**
Q. The load translates into energy at some point, doesn't it, after the failure?
A. **Force times distance is work. Forced times of distance divided by time is energy. So let's be very clear here. There was a force applied that exceeded the capability of the structure to resist.**
Q. And that's --
A. **And we want to be clear on your units and energy. You're kind of mixing this up, and I want to straighten that out a little bit.**
Q. I just wrote down what you said, it was the energy in the bucket. But maybe I --
A. **No, no. What you're having is, is now -- energy in the bucket during separation, it's a rotational inertia. It's a stored energy. Yes. That's different than what you two were asking. And**

so I wanted to clarify that.
Q. Okay. And I want to be sure that I understand your answer. Then you believe it is the load that was applied to the bucket that ultimately led to its failure and separation?
A. **It's a cascading failure, yes.**
Q. Do you have an explanation as to where that load came from? Within a reasonable degree of engineering certainty, do you have a reasonable -- do you have an explanation as to where that load came from that caused the failure?
A. **Yes. I believe it was his own weight. And what weight he could apply while he was in the air.**
Q. Well, his own weight, wouldn't it have failed when he got into the bucket?
A. **And what he could apply. I was very specific on it was very near going when he got into it.**
Q. What do you mean by what he could apply?
A. **I'm thinking, like, upper body strength. I mean, we can --**
Q. Again, we're just speculating now, aren't we?
A. **Yeah.**

MR. AHL: Okay. I think that's all the questions that I have for you. Thanks.
MR. SHIVELY: No questions.
MR. BEUCKE: No questions.
MR. GUENZEL: No questions.
MR. BEUCKE: We're done. He'll read and sign it.
(Deposition concluded at 1:10 p.m.)

CERTIFICATE

I, Marcy Benge, RMR, General Notary Public, duly commissioned, qualified, and acting under a general notarial commission within and for the State of Nebraska, do hereby certify that:

JOHN EIHUSEN, P.E.

was by me first duly sworn to tell the truth, the whole truth, and nothing but the truth; that the foregoing deposition was taken by me at the time and place herein specified and in accordance with the within stipulations; that I am not counsel, attorney, or relative of either party or otherwise interested in the event of this suit.

IN TESTIMONY WHEREOF, I have hereunto set my hand officially and attached my notarial seal at Lincoln, Nebraska, this 7th day of December, 2016.

____

General Notary Public

AMENDMENT TO DEPOSITION

CASE: KEASCHALL V. ALTEC/OSBORNE

WITNESS: JOHN EIHUSEN, P.E. ______No Changes

The witness herein states that he/she wishes to make the following changes in his/her deposition:

PAGE	LINE	NOW READS	SHOULD READ	REASON FC CHANGE

____

DEPONENT'S SIGNATURE

The signature above was subscribed and sworn to before me this ____ day of __________ , 20_.

____

GENERAL NOTARY PUBLIC
MARCY BENGE, RPR, RMR, CRR

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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEBRASKA

JULIE KEASCHALL, Personal Representative of the Estate of Kurtis Keaschall, deceased, and DAWSON PUBLIC POWER DISTRICT, Plaintiffs, vs. ALTEC INDUSTRIES, INC., and OSBORNE INDUSTRIES, INC., Defendants.	Case No. 4:14-CV-03070 DEPOSITION OF WILLIAM COLEMAN, M.S., P.E. TAKEN ON BEHALF OF DEFENDANTS

Taken at the law offices of Johnson, Flodman, Guenzel & Widger, 1227 Lincoln Mall, Lincoln, Nebraska, on November 30, 2016, commencing at 8:12 a.m.

APPEARANCES

For Plaintiff Keaschall:	MR. LARRY W. BEUCKE PARKER GROSSART BAHENSKY BEUCKE BOWMAN & SYMINGTON, LLC 1516 1st Avenue Kearney, NE 68848
For Plaintiff Dawson Public Power:	MR. STEVEN E. GUENZEL JOHNSON, FLODMAN, GUENZEL & WIDGER 1227 Lincoln Mall Lincoln, NE 68508
For Defendant Altec:	MR. ROBERT W. SHIVELY SHIVELY & LANNIN, PC, LLO 4400 South 86th Street Suite 100 Lincoln, NE 68526
For Defendant Osborne:	MR. STEPHEN L. AHL WOLFE, SNOWDEN, HURD, LUERS & AHL 1248 O Street Suite 800 Lincoln, NE 68508

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STIPULATIONS

It is stipulated and agreed by and between the parties hereto:

1. That the deposition of William Coleman, M.S., P.E., may be taken before Marcy Benge, RMR, General Notary Public, at the time and place set forth on the title page hereof.

2. That the deposition is taken pursuant to notice.

3. That the requirements of Neb. Ct. R. Disc. Section 6-330 (8) (A) and (C) are waived.

4. That the original deposition will be delivered to Mr. Stephen L. Ahl, Attorney for Defendant Osborne.

5. That all objections except as to form and foundation are reserved until time of trial.

6. That the testimony of the witness may be transcribed outside the presence of the witness.

7. That the signature of the witness to the transcribed copy of the deposition is not waived.

EXHIBIT C

WILLIAM COLEMAN, M.S., P.E.,

of lawful age, being first duly cautioned and solemnly sworn as hereinafter certified, was examined and testified as follows:

(Witness's response to oath: "Yes, I do.")

DIRECT EXAMINATION

BY MR. AHL:

Q. Would you state your full name for the record, please?

A. William R. Coleman.

Q. Mr. Coleman, my name is Steve Ahl, and we've just been introduced a few minutes ago. I represent Osborne Industries in regard to a lawsuit that's presently pending here in Nebraska that I understand that you have been retained to provide some services in connection with the investigation of an aerial lift bucket that failed; is that correct?

A. Yes.

Q. I'm going to ask you some questions. First I'm going to ask you some questions about yourself and your educational background to find out a little bit about you, who you are, what you do and what you've done. I'm going to ask you about your investigation and services provided in regard to this particular accident. Do you understand that?

A. I do.

Q. Okay. If I ask you a question that doesn't make sense or just seems awkward or you don't understand it for any reason, it's probably a bad question. So if you'd just stop me and let me know that I've asked a bad question, I'll be happy to ask it in a different fashion to make sure that we're talking about the same thing at the same time. Will you do that?

A. I'll do the best I can.

Q. Okay. And if as we go along you think an answer you've given me to a previous question is either inaccurate or incomplete for any reason, stop me and let me know that. I'd be happy to give you a chance to go back and either correct your answer or complete it, as the case may be. Will you do that?

A. I'll try to do all these things.

Q. Okay.

A. As best I can do them.

Q. Okay. And if you don't do any of those things, I'm going to assume you've understood the question, you've answered it truthfully and to the best of your ability. And can I rely on that as we go forward?

A. I hope so. I know you can expect

truthful answers. If I don't know, I don't understand your question, that's another thing. But I'm sure we can communicate fine.

Q. We'll try our best.

A. Okay.

Q. Okay. What is your current business address?

A. 1906 Atchison Drive, Norman, Oklahoma. The ZIP is 73069.

Q. What business is located there?

A. Analytical & Materials Engineering.

Q. What type of a business is that?

A. We specialize in analyzing metallurgical and material failures. We do laboratory testing. We do different types of materials analysis. We work for companies that have materials problems. It isn't all failures. Lots of times it's looking at a process that's ongoing, in need of improvement, or somebody just wants to know some things about the materials they're using.

Q. You say "we." How big a company is Analytical & Materials Engineering, Inc.?

A. There are five of us. But really there's only two -- three engineers: two full time, one intern.

Q. You're one of the full time?

A. Yes, sir.

Q. Who is the other?

A. Phillip Perkins.

Q. And who's your intern?

A. Right now it's a young man named Tyler Garde. That's G-a-r-d-e. There'll be another in the spring and probably a new hire in the summer.

Q. How long has Analytical & Materials Engineering, Inc., been in existence?

A. It will be 18 years this coming February.

Q. You've indicated that your business does a series of different types of activities from looking at failures to looking at different processes to improving products. I'm assuming that you also get involved in the forensics and in litigation; is that correct?

A. Yes.

Q. If you were to give me your best estimate as to what percentage of your time is devoted to working on lawsuits as opposed to working for a company trying to improve a process or a product, what would you tell me that is?

A. I would say about half of my time is devoted to litigation. Or things that may

potentially end up there.

Q. Okay. Does your business advertise in any legal publications for business in the legal --

A. **No.**

Q. -- setting?

A. **Sorry. I didn't mean to cut you off. No, we don't.**

Q. Okay. Have you ever?

A. **No.**

Q. Have you ever testified in lawsuits in Nebraska before?

A. **I don't know. It seems like I have, but I -- I can't recall. It's been a long time.**

Q. Okay. If you think of something as we go along, just stop me and let me know, and we can --

A. **Sure.**

Q. -- pick that up. What is your occupation or profession?

A. **I'm a metallurgical engineer.**

Q. And what is your educational background that got you to that position?

A. **I have a bachelor of science in metallurgical engineering. I received that from University of Oklahoma in Norman in '78. And then I have a master's degree also in metallurgical**

engineering, also from OU. That was in 1979. My minors were in analytical chemistry and physics -- I'm sorry. Analytical chemistry. Not and physics. And I continued into the Ph.D. program until about '85 or so. Well, when my daughter was born, so it would've been '86.

Q. Did that ultimately result in the awarding of a Ph.D. degree?

A. **No. I did not finish the degree. Family duties had to take precedence.**

Q. Okay. What is your position with Analytical & Materials Engineering, Inc.?

A. **It's my company.**

Q. You own it?

A. **Yes.**

Q. Is everyone else there an employee of yours?

A. **Yes. My wife thinks she owns it, but she's an employee.**

Q. We won't tell her that.

A. **I've tried.**

Q. Has that been true since its inception, that you've been the owner?

A. **Yes.**

Q. And you may have told me this. When did

that business -- when was it first formed?

A. **February of 1999.**

Q. Why don't you give me just kind of a thumbnail sketch of what you did prior to starting that business in 1999?

A. **Okay.**

Q. Let's start with your awarding of your bachelor's degree.

A. **Okay. This is somewhat overlapping, but I'll try to separate it as cleanly as I can.**

Q. Okay.

A. **After graduation, with the bachelor's degree, I was employed as a graduate assistant in the department of chemical engineering and materials science at OU, and I was responsible for lab classes, teaching labs, like a lot of graduate programs do. You kind of fold into the program by teaching and learning how to deal with students.**

At the same time, I was working for a company called Associated Metallurgists, who was -- that was formed by my advisor, my major professor at OU, Bob Block. The company name was Associated Metallurgists. And we did forensic work, failure analysis. That's what we got started doing. I did those two things -- I actually worked for Associated

Metallurgists from 1978, maybe even '77, the very tail end, through '99. And then I left to start my own company.

In the late '80s, early '90s, I became an adjunct professor in the department of chemical engineering. I taught courses, core courses in structures and properties of materials, physical metallurgy, failure analysis, corrosion and fraction mechanics. On an -- I was there on a teaching basis. I didn't have a research appointment. I did that until the late -- mid to late '90s. And then I went full time just into where I am now. So that period from '78 to 1999 was a mixture of consulting and academic work.

Q. Just listening to your description of what you've done in the past, it seems to me that the main focus of your education and day-to-day activities has been in the metallurgical area. Is that a fair reading of what you've just said?

A. **No, it isn't really fair. It's -- I can see why one would say that because of the degree name. And it does start out with metallurgical, but it ends up, when you deal with failures, you look at all materials eventually. I spend a great deal of time doing fractures of composites, plastics,**

glasses. Most of the work is metal. There's more metal than those other things around. So -- but through the years, it's -- there's more of an equal blend of things than there is just steels and coppers and aluminums.

Q. Have you had any specific training in composite materials?

A. **I took a couple of classes in college in -- which is really theoretical mechanics of composite materials. I've worked on lots of failures and had to learn on the fly, I guess you would say.**

Q. Those classes that you've just indicated that you had taken, were those at the undergraduate level?

A. **They were graduate courses. I took one when I was a senior per graduate credit, and I took another during grad school.**

Q. In coming here today, we served a subpoena duces -- or a notice duces tecum for you to bring your entire file that has been compiled since the beginning of the work on this case up through today. Did you do that?

A. **I did, but I -- I don't think I remember seeing a subpoena attached to it. There was a notice.**

Q. Okay.

A. **That doesn't matter to me. I bring it all anyway.**

Q. Well, let's just say it's a notice. But it asked you to bring your entire file, did it not?

A. **I'm sure it did, and I do. And I did.**

Q. Do you have your file with you today?

A. **I do.**

Q. Is that everything that has been generated by you or on your behalf since beginning work on this project?

A. **Yes.**

Q. Okay. Is that what's sitting in front of you?

A. **Yes.**

Q. Why don't we just hand that to the court reporter, and we'll have her mark that.

(Exhibit No. 109 was marked for identification.)

Q. (By Mr. Ahl) Okay. The court reporter has now marked as an exhibit the materials that are in front of you to your left as Exhibit No. 109. Is that the file that you brought with here -- with you here today?

A. **It is.**

Q. What all does that include? Why don't you just give me kind of a brief outline of what is included in there.

A. **I can. It's not that difficult. I have a working notebook. That's the blue one on top. I've got a file that contains discovery materials. Those would be answers to interrogatories and pleadings and that sort of thing. I've got copies of a few depositions. I have two engineering standards. I've got some technical literature. I think I've got copies of my photographs. Reports. Reports by other experts in this case. I think that's all. Oh, I've got the CDs, too, that were provided to me that have all the discovery answers and such on them.**

Q. You indicate the blue notebook. You've referenced that as a working notebook. What do you mean by that?

A. **I've got my -- my field notes in here, laboratory notes, photographs that aren't contained in my report. I have -- I've got the deposition notice. This is just things that I have generated or collected which are mine, as separate from these other pieces.**

Q. At any time have you removed anything that was once a part of this file?

A. **No. It's as it has been. It's just getting thicker.**

Q. Okay. Since beginning your work on this file, have you consulted with anyone or had anyone assist you in any way other than other employees of your own business with any facet of this investigation or analysis?

A. **Yes.**

Q. Why don't you tell me who?

A. **Okay. Two people. One is the director of mechanical engineering at OU. His name is -- I'm not sure how you pronounce it. I can't remember. Altas Gahn? I can pull his name up for you later at a break. And then another guy named Rick Doherty who is from Seattle.**

Q. Who is he, though?

A. **He was a gentleman that worked for a structural -- a fiberglass structural business in Seattle. I'm not sure what they do routinely. But their business was fiberglass.**

Q. Mr. Doherty's business?

A. **Yes.**

Q. Okay. Let's start with the mechanical engineer at OU.

A. **Okay.**

Q. When did you consult with him?
A. **It's been a couple of years now. Let me borrow my notebook there for a second --**
Q. Sure.
A. **-- before you take things out of it and tarnish it. I don't like talking about somebody without a name. I wasn't even close. Cengiz Altan, A-l-t-a-n, was his name.**
Q. Okay.
A. **I met with him first. And I met with him because I found a paper in the technical literature that addressed defects in resin transfer mold and composites. And I found out he was from OU. So I went to talk to him. Had one contact with him. That was it.**
Q. Do you remember when that was?
A. **It's been at least two years.**
Q. Okay. Did he provide you with any information or data that you have incorporated into any of your opinions or conclusions?
A. **No.**
Q. Did you provide any information to him about this case?
A. **I -- no. Other than -- I didn't talk to him about the case. I talked to him about resin**

transfer molded composites as a rule, as an entity of material.
Q. Okay. What did he tell you?
A. **Not very much. I think he -- and my reason for going there was because of the paper that I found. And I wanted to know what his -- I was really looking for information about the types of defects that were typically uncovered, either concealed or otherwise, visible to the eye, in those kinds of materials. And he didn't have that kind of background --**
Q. Okay.
A. **-- that could help me. So I didn't --**
Q. Didn't pursue it?
A. **-- consult with him anymore.**
Q. And you listed another individual that you consulted with?
A. **Right. Rick Doherty.**
Q. Yeah. And how did it happen that you consulted with him? Did you know him or --
A. **No, I didn't know him. I'm a little fuzzy on -- on how that began. But my recollection is -- and Mr. Beucke and Mr. Guenzel will correct me, I'm sure, if this is wrong. But my recollection was, is they asked me to find somebody that might have a**

background or an everyday interaction with some kind of fiberglass or composite material. And I -- I found him, I think, on the internet. That's what I remember.
Q. Okay. Did you consult with him on this case?
A. **Not really in a meaningful way. There was a beginning. And it never really went past the early stages.**
Q. Meaningful way may mean something different to you than me, so why don't you tell me what you did?
A. **Okay. I told him what I was doing. I told him I had a failure of a bucket, fiberglass bucket, basically a bucket truck, man lift bucket. And I asked for their -- their company's background in doing this sort of work. He ended up coming to Norman and looking at the bucket. And we had a couple of phone calls, but nothing past that as I remember. Nothing was really generated. It didn't have anything to do with my opinions. They do different things than I do.**
Q. As a result of his coming to Norman and making observations about the bucket, did he ever give you any impressions or opinions or anything of

that nature as to what may have caused the failure?
A. **The questions I asked him, he was unable to answer. And just because -- I don't know how far involved he got into the case other than the early onset work that was done.**
Q. Was he paid anything for his work?
A. **I have no idea.**
Q. Anyone else that you have consulted with in any fashion at all in regard to your work on this matter?
A. **No.**
Q. In your position as a consultant, have you ever had your testimony disallowed as a result of a Daubert challenge?
A. **Never.**
Q. Let's talk specifically about this case. Do you remember when you were first contacted?
A. **I do.**
Q. When was that?
A. **It was roughly a month after the accident, in July of 2012.**
Q. Okay. Who were you contacted by?
A. **Mr. Guenzel called my office.**
Q. Do you know how he happened to get your name?

A. No.

Q. When Mr. Guenzel called your office, you had a conversation with him, I'm assuming?

A. We did.

Q. Did he tell you why he was calling?

A. He did.

Q. What'd he tell you?

A. He told me there'd been a bucket truck on location. The bucket had fractured, fallen to the ground. The man in it was killed.

Q. Did he tell you anything else about the incident?

A. I need to look at my file. I couldn't tell you exactly what he told me.

Q. Okay. Why don't we -- why don't we take a look, then.

A. It keeps getting pirated across the table.

MR. SHIVELY: And I don't need it anymore.

THE WITNESS: It's okay.

A. Well, I was close. It was actually June the 8th, 2012, two days after the accident, that Mr. Guenzel called me.

Q. (By Mr. Ahl) Okay.

A. My notes, which are sketchy at best, reflect the lineman was working. A bucket fell off the boom. The truck and equipment were in storage in Lexington, Nebraska. He gave me some names of people and his firm name. And he said that he thought the manufacturer was Altec.

Q. Did he tell you anything else about the incident?

A. If he did, I didn't write it down.

Q. Okay. Did he ask whether this would be something in your area of expertise?

A. I'm sure he did. And I -- I recall also him speaking about, I understand you've worked on other bucket truck cases, and I said yes. And then we kind of went from there.

Q. Okay. At that point in time, did you become retained?

A. Yes.

Q. Were you provided any materials at that time or shortly thereafter regarding the incident?

A. I was. Shortly thereafter, I got some photographs taken by somebody. Maybe the sheriff. I'm not sure who took them. A little background information on what was going on, what happened. And then after that, I went up to Nebraska.

Q. Did anybody ever tell you what they thought may have happened? In -- in regard to why the bucket may have separated?

A. No, they didn't.

Q. Okay. What was the next thing that you did after talking with Mr. Guenzel, and I assume you got some background materials?

A. I did.

Q. Okay. What'd you do?

A. I went to the Dawson Public Power facility in Lexington and did a -- and inspected the bucket, the truck and the pole.

Q. Do you remember what you were asked to do in either the initial phone call or at some point in time in regard to the scope of your work? What was the purpose of you going there?

A. Well, the first purpose was to see what kind of failure had occurred. The second thing was to see what the failure involved equipmentwise. At the time, I didn't know whether the -- the boom had broken, whether a bolt had fractured. I didn't know. And Mr. Guenzel didn't know. So -- or at least if he did, we didn't discuss that. My first question was, I need to see this stuff. So he said, I'll arrange for you to go. So I came up to Nebraska.

Q. Okay. Were you asked to do anything in particular? To make any determinations? You were going to look at it, but what were you going to do with that information?

A. Well, the idea was to determine why it failed.

Q. Okay.

A. And because I'm a materials person, the second topic to be addressed was, are the material issues that are associated with this failure, did it contain defects that precipitated the failure. What can you tell us about the -- the broken bucket.

Q. So you -- you went to Lexington, Nebraska?

A. I did.

Q. When you got to Lexington, did you meet with anybody?

A. Yes, sir.

Q. Who?

A. Dean Kunkee, I believe is his name.

Q. An employee of Dawson?

A. Right. There were three people that I met. But he was the one that walked out in the shop with me. The other two gentlemen, one's name was Jeremy Kaiser, and the other was Bob Heinz.

Q. Did any of the three of them provide you with any information about the bucket, the truck, the boom or the incident itself?
A. **A little bit.**
Q. Who? Who told you -- who gave you the facts?
A. **Mr. Kunkee is what I recall. And I don't know that it was fact based, but it was -- the first question I had for him was, when are these inspected? Has this one been -- has anybody been here to look at it? Is everything as it was? You know, has it been touched or disassembled since the accident? And his reply was, everything here is preserved as it was when it left the scene. Nobody had disassembled. Nobody had done anything to the equipment. It was quarantined in the back, you know, cones around it, and tarps covering the bucket so it couldn't be dinged or beat up or whatever else you could do to it.**
Q. Were you provided any other information at that time?
A. **I don't remember anything else other than the few materials that I had before I got there.**
Q. Did you inspect the various components of the equipment?

A. **I did.**
Q. The truck?
A. **In part, yes.**
Q. The boom?
A. **Yes.**
Q. The components of the bucket that had failed?
A. **Yes, sir.**
Q. Anything else? The pole?
A. **Yes.**
Q. Anything else?
A. **Let's see. The truck, the boom, the platform, the bucket fragments, the bucket which had separated from the truck in addition to the bucket flap that was left attached to the truck, and the pole. I believe that's all.**
Q. There was still part of the bucket flap attached to the boom?
A. **Yes.**
Q. Did you think it was important to physically observe all of these components to arrive at ultimately your opinions and conclusions?
A. **Of course.**
Q. That's all of that equipment that you needed to see?

A. **It's what I saw. I tried to photograph things I thought were relevant. And not just associated with the accident, but with the general condition of the truck and the boom.**
Q. That was important to you in trying to formulate your ultimate opinions and conclusions?
A. **Yes.**
Q. Okay. As part of your observations, what did you do? Photograph the various components?
A. **Yes. I think you've seen the -- you probably have seen the -- the book of the photographs I took.**
Q. I have.
A. **So there was a lot of photographs taken. There was a lot to look at.**
Q. Okay.
A. **That ends up being my sort of working file as I'm going, you know, photographing the pieces, the condition of the items as I found them.**
Q. Other than make the observations that you did and photograph the various pieces of equipment and components that were present that day, did you do anything else while you were at Dawson that day?
A. **Well, I made some notes when I was there, if that's what you're -- I'm not sure what your**

question is referring to.
Q. Well, I want to -- did you do anything else?
A. **I didn't do any testing.**
Q. Okay.
A. **Let me back up. I understand where you're going with this. I was there to document the incoming condition of the failed components. Which included the things that it was attached to beforehand: the truck, the boom. You know, it's a -- it's a working unit. So I documented the condition of that. There was no testing, no disassembly, no nondestructive inspection or with some tools that you might use in the business that day. It was strictly to document what was there and what the failure involved.**
Q. And you did take some notes as you were going along doing that?
A. **I did.**
Q. And I suspect you were noting things of significance that you either observed or was -- or were photographing?
A. **I tried to. On a for instance, I took the information down off the templates that identified the manufacturer of the boom and serial**

numbers and those sorts of things.
Q. What else did you find of significance that you made notes of?
A. That the boom was cradled, meaning that it's resting on top of the truck as it would be if it was going down the road. Cradled means sitting in the saddle. I found the circumferential crazing on the boom.
Q. What's that?
A. It's -- crazing is a pattern of oxidation, and it's an indication of use at times and wear that occurs on materials. Crazing would be like you see the crack pattern on old dinnerware, for instance. You see it on the sidewalls of tires. I found that on the boom.
Q. Was that of significance to you?
A. Sure.
Q. Okay. Why?
A. Well, it just indicates the state of the boom at the time when I saw it. I didn't -- for instance, I didn't see any impact damage marks or areas where the boom was really distorted or defaced in any way. It wasn't damaged, per se. It just shows that the fiberglass on the boom is -- it's had a lifetime. It's not unusual to see it.

Q. Okay. Anything else that you noted of significance during your observations?
A. On the top side of the boom I found the typical wear zone, the contact zone that's along the top part.
Q. What do you mean by that?
A. It's the spot where the boom had the most contact with anything. Whether it's sitting on the truck or something it rubs against. You know, you're always looking at -- when I'm looking at booms, I always look at what sort of cosmetic condition is it in. And how would I describe it. And I would say there's always wear. There's always nicks and cuts. But I saw nothing that was graphic or demonstrative of abuse or any pre-existing problems that may have affected the way it serves as a dielectric. You know, an insulating boom.
Q. Okay.
A. Nothing structural I could find was wrong with the boom.
Q. Any other notes of significance?
A. I made a couple sketches of the wear patterns, the straps, the warning locations. And I sketched out the segment of the bucket that had fallen and the segment that remained attached to the

boom. Those are all of my notes that were made that day in addition to the photographs.
Q. Okay. And those are contained in your working file?
A. Yes, sir.
Q. And are they under any particular tab so if we want to go back to find them again?
A. Inspection note, 7/13/2012.
Q. Okay. You've told us about your inspection. You've told us about your photography. You've told us about making notes of significant findings. Did you do anything else while you were at Dawson that day?
A. Are you asking about whether I did things other than look at the bucket?
Q. Yeah. Other than the things I just noted. You made your observations. You looked at the truck. You looked at the boom. You looked at the platform. You looked at the fragments. You photographed it all. You made notations of different things that you saw that you felt were significant. Did you do anything else while you were present at Dawson during your time of investigation?
A. Other than a conversation with Dean Kunkee, no.

Q. And was that the conversation you've already related to us, or was there another one?
A. Well, there was kind of a beginning and an end to the day.
Q. Okay. Why don't you tell us about the end to the day?
A. It was more of just a closing conversation. I've done what I needed to do. I'm going to ask Mr. Guenzel to have the components of the bucket shipped to me. Be on the lookout for that. When you package it, I'd like you to do it this way. And I told him how I wanted the packaging. That's what I remember talking about. That's not every detail, but it's close.
Q. Okay. Was either Mr. Beucke or Mr. Guenzel there with you?
A. No.
Q. Just you?
A. Just me.
Q. Did you spend any additional time at Dawson during this visit, other than the day you were there performing the functions that you've already detailed for us?
A. No.
Q. Have you ever been back?

A. **No.**
Q. Did you tell anybody at Dawson to maintain control of the boom and the truck because of its significance to this accident?
A. **Yes.**
Q. Who did you tell?
A. **Mr. Kunkee. I told him that because this was part of an investigation of a failure and an accident, that there will be other people here at some point to look at this. So keep it where you can preserve it.**
Q. Okay. Did he understand that?
A. **You'll have to ask him.**
Q. Okay. Did he seem to?
A. **I suppose so.**
Q. Okay. Maybe I asked you this: Have you ever been back to Dawson?
A. **No.**
Q. Have you ever talked with Mr. Kunkee again?
A. **No.**
Q. After your --
A. **I don't think so. Unless I had to give him an address where to ship it.**
Q. Okay.

A. **I don't think I did, though.**
Q. But I mean about substantive --
A. **No.**
Q. -- items in regard to this failure?
A. **No. Sorry I cut you off again.**
Q. That's okay.
A. **I did not.**
Q. Ever talk with anybody else from Dawson about anything substantive having to do with either the failure or this incident?
A. **No, sir.**
Q. You indicated you were going to have the bucket shipped back to your address?
A. **Right.**
Q. I'm assuming that occurred?
A. **It did.**
Q. When?
A. **I don't know that I have the -- the shipping receipt here. But I can find out when that was.**
Q. Just give me a general idea. Within the next month?
A. **It was fairly soon. It wasn't a long time.**
Q. Okay. That was shipped to Analytical &

Materials Engineering, Inc.?
A. **Yes, sir. Yes, sir, it was.**
Q. Do you have a laboratory there?
A. **Yes.**
Q. And it's fully equipped with everything that you need to do this type of analysis?
A. **That's not a fair question. But I'll give you the answer that goes with it.**
Q. Okay.
A. **Nobody has everything. I have microscopes. I have certain types of metallurgical equipment. I've got all kinds of stereomicroscopic equipment with cameras attached. And we've got hardness equipment and metallurgical equipment and some load cells and those sorts of things.**
Q. X-ray equipment?
A. **I hire it out when I need x-ray done. Just like I don't have an FTRI unit. I hire it out. I wouldn't use it enough to justify having it.**
Q. The bucket is -- the platform and its components are shipped down to your business. It arrives there. Why don't you tell me what you do?
A. **What I do when I get it, or what I do when -- in general?**
Q. No. When you get it, what do you do?

A. **The first thing is to uncrate it.**
Q. Okay.
A. **And see when it's uncrated if it was undamaged from transit.**
Q. Okay. What did you determine?
A. **That it was packaged correctly and safely and that there was no damage to the components any different than what I saw at Lexington.**
Q. The scope of your work hadn't changed? You were still focused on trying to determine why this failure occurred?
A. **Yes.**
Q. Were you trying to determine anything else?
A. **I think it all comes back to investigating the failure of the bucket or whatever that entails. That was my -- my goal. That's why I had that part shipped.**
Q. Did you have a plan at that time as to how you were going to go about your analysis to see if you could determine why the failure occurred?
A. **I think the idea was to formulate a plan when I had the pieces in front of me.**
Q. Did you formulate a plan?
A. **Yes. To a degree, I did.**

Q. Okay. Well, why don't you tell me what you formulated that you were going to do to help try and arrive at a conclusion or an opinion as to why this failure may have occurred?

A. The first thing I did was to -- after photographing it just as it came in was to examine the fracture surfaces to determine the origin of the fracture and to see if the origin contained evidence of manufacturing or fabrication defects. Those --

Q. And how did you make those observations?

A. Well, I looked at them.

Q. Just --

A. I put them under lights, laboratory lights, microscopes. I did those things that I would normally do when examining a fracture of any material. I documented the surfaces of those fractures. I made a bunch of measurements. And eventually I came to the point where I needed some information on the manufacturer of this product, these kinds of products. So at some point thereafter, I advised Mr. Guenzel that that would be something I would like to do. That's as far as the plan got at that point.

Q. So you photographed the components again or the various pieces. You looked at them with your

naked eye under lights as well as microscopically?

A. Right.

Q. And you ultimately recorded your observations?

A. Yes.

Q. How did you do that?

A. Photographs.

Q. And those are contained in the photographs that we've received from you on a prior occasion?

A. Yes.

Q. Did you do anything else at that time with your original plan up to the point where you determined you'd like to get some information from the manufacturer?

A. I thought it would be a good idea to involve someone who was a -- had different skills in structural analysis to examine this equipment and provide some input on what sort of loads and stresses would be in different parts of the bucket.

Q. You didn't feel comfortable that your company or you could do that?

A. That's not my area.

Q. Okay. So you didn't feel comfortable trying to do it?

A. Whether I felt comfortable or not was one thing. Whether someone else is more qualified to do it is another.

Q. You didn't feel you were the person to do it?

A. I wanted some help doing it, because it's not something I could do economically or -- or quickly. Which I suppose is the same thing.

Q. Let me ask you this: Did you ever have one of your students or an intern or somebody from your business ever contact Osborne telling them that they were from the University of Oklahoma to try and get information about this product?

A. No. In fact, I would have said the otherwise, the other way. I said, we never call a party that's potentially involved in a case for information. That's not the right path to do things. So they would not do that.

Q. Okay. So if Osborne has a record that indicates somebody identifying themselves from the University of Oklahoma asking about information on this product, you wouldn't know anything about that?

A. No.

Q. Okay.

A. There are other people on the faculty

that deal with these problem -- kinds of problems. Not necessarily from a materials or mechanical standpoint, but from an electrical standpoint. I don't have any affiliation with -- on any of those things. And I wouldn't direct someone to do that.

Q. Okay. I just wanted to make sure that you wouldn't know anything about that, if they have that information in their data?

A. No. And I'm not affiliated with OU anymore, either.

Q. Okay.

A. So that's somebody else.

Q. Were you back at the -- back when you first got involved in this project?

A. No, sir. I -- I haven't been affiliated or taught class at OU since the late '90s.

Q. Were any of your interns from OU back at that time?

A. The interns are always from OU. The ones I've had.

Q. Okay.

A. At that time, I don't even know that I had an intern.

Q. Okay.

A. I'm not sure.

Q. Okay. If they would have the name of the individual, we could tell you that, and you could tell us whether you knew them and whether they were ever an intern for you?

A. I sure could.

Q. Okay.

A. And I'm not afraid to tell you if -- if there was. But there's nothing in the file that shows that. And we make records of things like that when we're chasing details.

Q. Okay. You indicate that you got to a point where you believed that you needed information from the manufacturer, and that was kind of the end of your initial game plan?

A. Yes.

Q. What happened next in your investigation and analysis? What did you do next?

A. Mr. Guenzel and Mr. Beucke came to Norman, and I shared with them what I had found. A bit of the game plan. That's really what they came down for. Maybe just to meet me to see if I was real or not. I don't know.

Q. Okay. What did you show them that you had found at that point in time?

A. Well, I showed them the condition that

the bucket was in and the issues I needed information about and advised them at the time that we might need to involve another person. I think that's how it began.

Q. Okay. Did anything come out of that discussion in terms of a new game plan or what was going to happen next with your involvement?

A. I think it was -- and this is somewhat speculative, because I don't know the details of the conversation. But it was, I need to find somebody that has a background in manufacture or structural analysis of these components, similar components.

Q. Okay. And was that ultimately done?

A. Yes.

Q. Was that Mr. Eihusen that was ultimately brought on board to do that, do you know?

A. As far as I know, yes.

Q. Well, let's get back to what you were doing. You had -- you had looked at the fracture sites under microscope and under lights. What was the next thing that you did to arrive at any opinions or conclusions that you ultimately hold?

A. I'm uncertain of the chronology of events, but at some point I looked at inspection records and -- of the truck involved. I looked at --

I think I've already said photographs. We discussed a plan of attack, so to speak, in doing a different kind of analysis on the bucket than I was ordinarily inclined to do. Which we've talked about.

I think after that -- and all this was nondestructive. There was no testing, anything invasive done on the -- the evidence as I received it. There were no cuts. There were no -- no testing of any kind was done. I felt like at some point, it would be done. And -- and shortly thereafter, I think my involvement sort of slowed down. I didn't do anything with it for quite some time.

Q. Okay. What initially was the type of analysis that you wanted to do that you say ultimately was changed to a different type of analysis?

A. Well, I don't know that it's what I wanted to do, but it was at least a first approximation of determining what would be the most useful steps in the laboratory to do. And one of them, of course, was to -- to have a section removed from the bucket body so we could determine the chemistry of the materials to determine what they were made of, what the bucket was made of. To look at the fibers in cross-section to determine what sort

of structure was inside the rim of this bucket. Those are the things I was concerned with. In addition to the -- the foreign material that I saw on the inside of the fracture origin, some sort of yellow compound that was present. I didn't know why it was present. I wanted to know what it was. I wanted to know if it was typical for products of this type to have a foreign body inside them. That's where it came down to finding someone who was familiar with the process, who understood the mechanics of fabricating a bucket.

Q. Those questions and concerns that you had about the discoloration and the fracture surfaces, did you ever do anything to answer those questions yourself?

A. I didn't perform a test on it at the time because I didn't have the authority to do it. Later on down the calendar of this case, apparently some work was done on that. With limited success. I didn't participate in that. I didn't know that it was going on. So I didn't do those tests. But I was aware that the substance at the fracture origin would be of importance to know.

Q. After -- have you now told us everything that you did while you -- after initially receiving

the bucket down at your laboratory in terms of trying to determine the cause of this failure?

A. At that time, yes. Other than take some dimensions of the bucket.

Q. Have you ever done any experiments, testing, or performed any calculations whatever in -- in regard to trying to determine what the failure of this bucket may have been?

A. Experiments can't be performed on this piece of evidence. You can do laboratory work that's invasive, cutting it up. I know what I asked to have done, and I know that part of that work is an examination at the fracture. So that really isn't an experiment, but that's part of the evaluation and the, quote, unquote, testing phase from my end.

Q. Making your observations, that's part of your testing?

A. Absolutely. Because the -- the critical part of what I do is looking at fracture surfaces. That in itself is a type of test. It's just not where you break something with a hammer and see what happens.

Q. Other than making the observation of the fracture surface, did you do any other testing, experiments, calculations or any other scientific

process to determine what was the cause of this failure?

A. I was not involved in that part of this work.

Q. Okay. So your answer is no?

A. That's true. I didn't do tests as you said them. As long as you understand that you don't have to go put a meter and a gauge on something to have a meaningful examination and make that part of your test or analysis. As long as we're on the same page there, then -- then we can move on.

Q. I think I understand your answer.

A. Okay.

Q. You're not telling me that you can determine what caused the failure simply by looking at the fracture surfaces, are you?

A. Sorry. I missed the first part.

MR. AHL: You want to read that back to him?

(The requested portion of the record was repeated.)

A. Oh, yes, you can.

Q. (By Mr. Ahl) You can?

A. You bet.

Q. So that's all that's necessary in this

case, is just to look at the fracture surfaces?

A. Well, it depends on what information one is trying to gather. My information that I needed was, where did the failure occur. And is there a defect in material that is coincident with the origin. That's what I'm looking for. It's the same way if you look at metals. You're trying to isolate an origin and determine whether or not it's from a load history or it's generated from a localized flaw. And that's sort of the -- the approach you have to take when you're looking at a fracture.

Q. So that's all you needed to do in this case?

A. It's what I needed to do.

Q. Okay.

A. There are other questions that can be answered by other people doing different things. And there's lots of peripheral information that I like to have. But as far as determining this is where it starts, this is the problem, I did that.

Q. And maybe we're just talking about the cause of the failure as being -- maybe we've got a semantic difference there.

A. Okay.

Q. Are you telling me that you can simply

look at the -- the fracture surfaces of this material and determine whether it was an overload, whether it was some other type of outside force, or whether the bucket just simply failed by looking at that fracture surface? Is that what you're telling me?

A. I'm telling you that what I can see is an origin and a defect cluster at the origin. And defects at a fracture origin denote a problem in the fabrication of the device. That's what I need to answer, the first question I was asked to answer. The second part of my work would be to, what is the foreign material? And I would have done that had I stayed involved with the case for that period of time, but it just didn't -- that wasn't something that I was asked to do.

Q. Well, when you find your -- the defect cluster that you've just talked about, did you ever do any testing to determine what the structural significance of that defect might be?

A. No. That wasn't part of my assignment.

Q. And we don't know that in this case, do we?

A. No.

Q. Have you ever seen any testing that would -- that would indicate that?

A. **That would indicate what?**
Q. The structural significance of any defect in the manufacturing process that you just talked about.
A. **Well, the structural defect -- the effect of the structural defect is right in front of us. That's the failure. That's the consequence of it.**
Q. But we --
A. **I don't need to make calculations to know that.**
Q. You don't need to know how much force or load it would take to cause a failure at that -- at that location where you've indicated there's been a defect? You don't need to know that?
A. **No, I don't. In fact, on a whole part, one that's completely defect free, it's good to know those kind of numbers. That's the way you would have to categorize the integrity of the -- the product that you make, is to know -- is on paper, does it match what you see in the field. How much load will it take. And it passes -- those kind of things pass all the exams and the test loads that the standards require. But it -- it may not necessarily during one of those tests uncover the presence of a critical defect in the material.**

Q. How long had this bucket been in service, do you know?
A. **Seven years.**
Q. Okay. And had it failed before?
A. **Not that I know of.**
Q. Okay. You shipped the bucket back to Nebraska, ultimately?
A. **Yes.**
Q. Do you know when you did that?
A. **I've got record of it somewhere. It would be -- I know I have it. Putting my fingers on it in the file is another thing, but I do have record of it.**
Q. After you shipped the -- the bucket and the --
A. **Time-out. Sorry to interrupt you.**
Q. That's okay.
A. **June 29th of 2015.**
Q. Okay. After shipping the bucket and its parts back to Nebraska, have you done any other analysis in regard to this particular incident or the failure of the bucket?
A. **Yes. I have looked at benchtopwise and microscopically the cross-sections that were cut from the bucket by -- adjacent to the failure.**

Q. Okay. And when did you do that?
A. **Between -- well, it's not between. Let's say the end of the summer when I received those parts back. Probably between August and September.**
Q. There was some -- some -- an examination done out in California and some -- some testing done?
A. **Yes.**
Q. Were you part of that?
A. **No.**
Q. The parts that you received, were those provided to you after that work was done out in California?
A. **Yes.**
Q. And you examined them microscopically?
A. **I did.**
Q. And is the results of that microscopic examination also in your working notebook?
A. **Yes, sir.**
Q. Why don't you tell us what you did, what you saw, and what the significance of that was to you?
A. **What I did was -- let me first tell you what I received so we'll be sure that that is clear to you.**
Q. Okay.

A. **I received the specimens that were labeled "A," "B," "C," and "D" as they were -- as the work was done in California. So it's a chunk of the bucket that you can hold in your hand, a small piece, cut from the bucket body. That was "A" at the origin of the fracture and "B" at the other primary failure origin on the rim of the bucket. So two clumps of material saw cut from the bucket body.**
There was another flap of material from the -- the side of the bucket, for lack of a better way to describe it. Not the rim, but the -- the flap of material that came with the rim when it pulled away. About palm size.
Q. Okay.
A. **And then there was a small fragment that had been cut from one of these pieces that was used in the laboratory work done at Exponent. I had those four pieces. I spent my time with "A" and "B," the two parts adjacent to the fracture and where the cross-sections had been exposed when they were cut. What I did was examine those under the microscope. I photographed those pieces. I found a myriad of cracks, internal delaminated areas, and internal crack zones in those cross-sections. There was a discoloration at the surface of the flaws. It was a**

pretty nasty looking cross-section, to put it mildly.
Q. Okay. And what, if any, impressions or conclusions did you draw from your observations?
A. It told me that the -- the defect population was -- was high. That there were -- there was enough discontinuity in the section to weaken it in the presence of whatever load it was going to see and that it was going to cause -- I could understand why the failure began in this location with so many anomalies in the material.
Q. Did you ever do any calculations, testings, or experiments to determine what load it would take to actually create a failure in the areas that you've just identified?
A. I didn't do calculations to do what I could see with the naked eye. When there is a flaw that runs nearly the entire length of the cross-section and was a gaping wound in the cross-section, I didn't see any reason to calculate that. There was enough of it in there to understand completely why the failure could have occurred.
Q. So you don't know what level of load it would have taken to cause that area to begin to fail or fail. Fair statement?
A. No one can know the load that it takes to

fail this cross-section exactly. Because every section will be different.
Q. And I'm not talking about exactly. You didn't do anything to help you determine generally, specifically, or exactly what load it would take to cause that area to fail, did you?
A. No, I didn't. I didn't need to.
Q. Okay. Other than observing things either microscopically or with your eye and photographing them, did you do anything else?
A. You make it sound so trivial when you phrase it that way, and it's not that way at all.
Q. Okay. Well, if I'm making it sound trivial, I apologize. But did you do anything else?
A. My work was done at that point.
Q. Okay.
A. It was sufficient to -- to tell Mr. Guenzel and Mr. Beucke that this bucket failed because it had internal defects. And the structure in the area that's most critical, where this thing is nearly attached to the rib and to the boom, has a problem with it. And I showed them what the problem was, and we discussed it. My work at that point was done.
Q. And you've not done anything since?

A. I've read depositions and the like, but I haven't done any more lab work.
Q. Okay. You've seen the photographs of the scene where this occurred, where the truck was, where the boom was, where the pole was?
A. Yes, sir.
Q. Have you done any work at all to develop any type of a reconstruction as to how -- how this incident occurred?
A. No. I haven't been asked to do that.
Q. Are you familiar with the fall protection that was available for Mr. Keaschall to use that day?
A. Why, sure. I've worn them many times.
Q. Do you believe that that is a safety requirement that should be followed when you're working in a man lift bucket like this at the height Mr. Keaschall was at?
A. Well, sure it is. That's a common thing in the field. He had his harness on. I don't think it was attached to the D-ring. He may have thought it was and it wasn't, but he didn't -- it wasn't at the time he fell.
Q. And having the harness on without having it attached is like not having it on, isn't it?
A. Yeah, it is. That's true. You know,

that's -- that is designed not to help you in case the bucket fails. It's designed if you fall out of the bucket, if you get shocked, if you get pulled out from some other means, that'll protect you.
Q. It's also going to keep you from falling to the ground if the bucket fails; correct?
A. And it also has no relation to the defects in the tub.
Q. I didn't ask if it did. I just said it's going to keep you from hitting the ground if the bucket fails, isn't it?
A. In that strict of sense, yes, it would.
Q. Okay. So Mr. Keaschall would not have fallen to the ground that day if he simply would have attached to the D-ring his lanyard for the fall protection that he had on. You agree with that?
MR. BEUCKE: Excuse me. I want to object to the question. Lack of foundation and asks this witness to speculate.
Q. (By Mr. Ahl) Go ahead and speculate.
A. In theory, no. I mean, that's -- that's what the device is called. It's a fall protection piece of equipment.
Q. As required by OSHA?
A. Yes.

Q. Did you get into the details with Dawson as to whether or not they required it?

A. I didn't really need to discuss it with them. I knew they required it.

Q. Okay.

A. Like I said, he had it on. He may have forgotten to attach it or maybe it came unattached. But they know the rules.

Q. Yeah. And not having it on and attached would be a violation of both OSHA and those rules of Dawson. Agree with that?

A. Yes.

Q. After concluding your work, on page 7 of your report you list certain conclusions and opinions?

A. Yes.

Q. Why don't you get your report out, and let's talk about those for a minute.

A. Okay.

MR. SHIVELY: Can we take a break?

MR. AHL: Yeah. Why don't we take a five-minute break before we get started on these.

(At this time a brief recess was taken.)

Q. (By Mr. Ahl) Okay. I think we ended up

by starting to look at page 7 of your report, which includes your conclusions and opinions?

A. Right.

Q. Are those all of the conclusions and opinions that you've arrived at in regard to your work on this matter?

A. I think so.

Q. Okay. And it indicates that based upon your macroscopic and laboratory examination of the evidence vehicle, lift assembly, fiberglass man lift bucket, the materials and documents reviewed, your education and work experience, those are your opinions and conclusions; right?

A. Yes.

Q. And does that statement there include all of the bases for your opinions? That is your examination, both macroscopically and laboratory examination, your viewing of the different components, the documents that you've reviewed and your education and work experience. Anything else that you've used to formulate any of your opinions or conclusions?

A. I think that covers it. You know, there's a lot of experience involved in looking at fractures and determining why they occur.

Q. Okay.

A. But I think that it's covered there.

Q. Okay. Let's talk about your first opinion or conclusion that says, "Inherent manufacturing defects have been discovered in the subject Altec/Osborne man lift." And then you go on to say, "These defects include foreign material and zones of incompletely cured resin, resulting in specific planes of weakness. Fracture of the bucket can be traced directly to the regions containing these flaws." Why don't you, in laymen's terms, tell me what you're saying there.

A. I thought that was pretty clear. I think I did it earlier, but I'll try to do it again. Maybe I can do it cleaner. There are zones and regions of weakness in this cross-section. And because they represent inhomogeneities in the material and thus are present in the load bearing cross-section, their response to loading is such that it will cause immediate fracture. The areas that I saw were a combination of uncured sites, incompletely cured sites. There are open cracks now. We don't know when they formed. They may have formed during the lifetime of the product. They may have been formed early on, right -- during the manufacturing. We will

never know those answers. But those defects are at the origin of the failure, along with that foreign substance that's there.

Q. Okay. And exactly where on the lift bucket do you determine that area to be?

A. It would be the location that's been labeled "A."

Q. Okay.

A. By the various experts that have looked at this.

Q. Okay.

A. It's the area where the rib is next to the flange.

Q. Okay. And that's where you have discovered the defects that you've talked about with the foreign material and zones of incompletely cured resin?

A. Yes.

Q. Okay. Did you do anything to determine what the effect of that defect would be on the strength of the bucket in that location, if any?

A. I didn't need to do anything. It was -- the fracture that occurred told me what the effect of those defects were.

Q. The effect on the strength of the

material?
A. Or lack of strength as it may be, yes.
Q. Do you know how much load was on this bucket at the time it failed?
A. I don't know.
Q. Number 2, "The fabrication defects, which are primarily sub-surface, precipitated fracture and premature failure of the fiberglass man lift bucket." Then you say, "Fracture could have been instantaneous or progressive, or perhaps both. Neither scenario would have provided a warning of impending failure."
Let's take -- let's break that down. The fabrication defects which are primarily subsurface precipitated fracture and premature failure of the fiberglass man lift bucket. What do you base that on?
A. I saw no flaws that began at the surface or in the gel coat. I saw them in the cross-section inside the ring form. So those would be considered subsurface. They're not visible to the naked eye.
Q. Okay.
A. That's the reason for that comment, is that -- are we just going with the first sentence here, or are we continuing?
Q. And "precipitated fracture and premature

failure of the fiberglass man lift bucket," what do you base that on?
A. Well, there's no indication from looking at the bucket beforehand that failure was imminent. There's no indication that there was a crack at the surface that precipitated at the surface, as I said, and moved to the interior of the rib wall and caused the failure. The flaws are on the inside. That's the structural part of this device. Not the surface coating. So the fracture began there and at whatever flaw was present when the bucket was loaded.
Q. In your investigation and the testing that you did, were you ever able to determine whether or not, with the defects that you say that you found that were present in this bucket --
A. Right.
Q. -- whether or not it still would have performed at the level of load that it was designed to handle? Do you know that?
A. I don't know what the loading was. So I can't answer your question cleanly. And I also don't know the extent of the defects or all of their orientation or if they're more dense in one area than others.
Q. And I guess what my -- the essence of the

question is, even if we take your first opinion or conclusion at face value and say that you -- and we agree that you found these defects in the manufacturing process, the foreign material and the zones of incompletely cured resin, I guess what I'm wondering is whether or not you have done anything to determine whether or not the platform still could have performed as it was designed to perform under the conditions and load that it was designed to handle with those defects. Did you do anything to determine that?
A. Not -- not a calculation or a specific test.
Q. Okay.
A. Not to -- not to put a boldface on what I already know.
Q. And we don't know what it was -- how it was loaded at the time of failure, do we?
A. No. We don't know. We don't know -- I mean, the typical loading on these things, whatever foreseeable use there is, it has to be able to -- the bucket has to be able to handle the things that even you don't want it to do. That's why you warn about it. Because you know what will happen if you do that. And if the defects are there, then the loading

scenario really doesn't matter. You know what a good one is and you know a good one will withstand a lot of load.
Q. And we do know that sometimes operators get these hung up on things and can create a load on them by either getting them stuck on a pole, for instance, or pushing against something that they shouldn't be?
A. I would be surprised if those things didn't happen on a daily basis.
Q. Okay. And we don't know what type of a load those create?
A. No. It's a foreseeable use.
Q. Okay. Number 3 says, "The defects were present at the time the man bucket left the control of the manufacturer." How do you know that?
A. Well, they're inherent flaws. We've got areas that are uncured slash unbonded in the cross-section. It may be a bit fair to talk about that without -- about looking at the end of this middle sentence in item 2. Because it says we don't know whether fracture was instantaneous or progressive. And that really means that the cracking doesn't have to show up immediately when it's made. It may be that the condition of this cross-section of

the bucket is prone to cracking at some point in its lifetime as it ages. So whatever defect population was there at the onset may have increased during the useful life of the bucket. And we don't know which one it was.

Q. You can't tell that by your observations?

A. **No. You can tell a fatigue crack from a -- an instantaneous load or a corrosion crack, for instance, in many materials, metals and plastics included, and composites. But in this instance, it would be more of a progressive weakening of the cross-section because of the likelihood of plastics breaking down and crack networks forming during routine service. So we don't know exactly how bad it was or when it went.**

Q. Okay. And would that be more true if this platform and the boom would have been loaded to -- from time to time at a rate much greater than its rated capacity? Would that facilitate the cracking, if a much greater load than what it's rated for was placed on it?

A. **It might contribute some of it, but it would certainly be loading that you would anticipate, because these things are -- these things are overdesigned in theory. They're designed to take a**

pretty healthy load. They don't work when they have problems inside. That's the problem. We can't disassociate a load with the failure because the defect orientation and population is unknown.

Q. I'm assuming that throughout your career you've looked at a lot of fiberglass, a lot of resins, a lot of different materials that include those -- those items?

A. **Yes, sir, I have.**

Q. Is it common for a component that is made out of fiberglass to have some areas of -- where the resin has not completely cured?

A. **Yes.**

Q. And in each case, that wouldn't be termed a defect in the manufacturing process, would it?

A. **I would say on a localized basis, it would be more of a -- of an isolated flaw. It -- I would make an analogy to a piece of pipe that is intended to be seamless when made at a pipe mill, meaning it isn't put together by welding. It's -- it's made by the metal being formed with a mandrel when it's really hot. And there are times when metal folds over on itself and doesn't rebond with the sub straight beneath it, and it has what we call a seam. And a fold or a lap or a seam in a piece of tubing**

sits there in a benign way until it happens to be loaded in a way that makes the defect explode.

It's close to what we have here, is a defect that lays in wait. But as the product ages and the crack network grows and becomes concentrated in a heavily loaded area, it will fail at a lower load.

Q. And, again, we don't know in terms of this bucket or any of the Osborne buckets based on the defects that you discovered in your analysis what load it would have taken to cause that failure?

A. **That's right. We don't know.**

Q. Would you agree with me that if we went out and looked at any component that's made completely out of fiberglass, we would find areas of incompletely cured resin in that?

MR. BEUCKE: Excuse me. Are you talking about any component in a bucket or any fiber --

MR. AHL: Anything made completely out of fiberglass that we would find areas of incomplete cured resin.

A. **I would say it would be likely you would find areas like that. It's not a perfect process. Because it is a composite. So it's put on in pieces as opposing to being something like a metal that's**

moved around and shaped to a form. This is made to a form. And all cast materials have products -- or have problems with them. Metals like plastics. And when the defects are concentrated or there are foreign things in the cast material, it may live for a while. And then it may die suddenly. Without warning.

Q. (By Mr. Ahl) Let's go to number 5 where you -- you proffer the opinion that the decedent, Kurtis Keaschall, neither caused nor contributed to the failure of the man lift bucket. See that?

A. **I do.**

Q. What's the basis of that opinion?

A. **There isn't evidence in my view that any type of overload symptoms existed. I know we have a failure of a material, and there is a load that made it go. I can't deny that. But in terms of him doing something that -- that caused the defects, no. He didn't do that. He didn't damage the bucket by sticking a knife through it and doing things that made it fail early. The defects were inherent.**

Q. Okay. And you don't know what load he had on that bucket at the time of the failure?

A. **No, I don't know.**

MR. AHL: Okay. Do you have that

photograph from yesterday?
(At this time an off-the-record discussion was had.)
(Exhibit No. 110 was marked for identification.)
Q. (By Mr. Ahl) Let me show you what now -- the court reporter has now marked as Exhibit No. 110. Have you seen that photograph before?
A. I have.
Q. That's one that was provided to you --
A. Yes.
Q. -- correct? What do you understand that photograph to depict?
A. What I understand what it shows?
Q. Yeah.
A. Well, it's the scene. The accident scene.
Q. Okay. And is it your understanding that that's the accident scene as it existed right after the accident, after Mr. Keaschall obviously has been removed?
A. That's the way I understand it.
Q. Okay. Shows the orientation of the truck and the boom and the pole, and over on the far right-hand side, about two-thirds of the way down, we

see the bucket?
A. Yeah. We know that the truck is in the position it was in, most likely, because the outriggers are still deployed. And, as I understand it, no one got in and moved the controls. I don't know about the bucket location, but it is what it is in this picture.
Q. Okay. And I think -- why don't we accept the -- the testimony that the bucket is in its final rest area after it failed off of the boom. Okay?
A. Okay.
Q. Do you know what the distance from the pole over to the truck would be? Did you see that measurement?
A. There was a measurement made. I don't recall what it was.
Q. Do you have that anywhere in your materials?
A. If I have it, it's -- I think what you're referring to is the drawing that the early investigation provided.
Q. Right. Is there a measurement there from the pole to the truck?
A. There is a pole to truck.
Q. What's that distance?

A. It says ten feet.
Q. Okay.
A. Now, we don't know which part of the truck. That's what it says.
Q. Okay. But you wouldn't expect it -- would you expect it to be the side of the truck that's closest to the pole?
A. Intuitively, that's right. But sometimes those intuitions are proven wrong.
Q. Okay. Well, let's assume --
A. That's all you can go by for now.
Q. Let's just assume that's right, too.
A. Okay.
Q. In your analysis of this failure, did you ever determine when the bucket detached, how it came off the boom and where it ended up?
A. No.
Q. Is that important to you?
A. Not in what I was doing.
Q. Okay. If we assume that the pole is ten feet away from the truck laterally -- okay?
A. Okay.
Q. That's what your pic- -- that's what your diagram shows; right?
A. That's what the number says.

Q. When this bucket detached, it had to move ten feet laterally if it hit the truck. Is your understanding that it hit the truck or not?
A. Well, I know people have suggested that that was the reason for the deformation of the channel on the side of the truck.
Q. Okay. And the reason for the paint transfer from -- of the red from the truck to the bottom of the bucket? You saw that, didn't you?
A. I did.
Q. Okay. And do you have another explanation for that, the deformation of the rail or the mark on the bucket?
A. I don't.
Q. Okay. If that -- if that's true that the bucket, when it separated from the boom, came over and moved laterally ten feet and hit the -- do you see the deformation of the rail on the truck?
A. Sure.
Q. Okay. Let's assume that that's what happened. And then the bucket hit that and then ultimately ended up over at its place of rest. Do you have an explanation of how that bucket moved laterally ten feet from the pole over to the place where it would have struck the truck?

MR. BEUCKE: Let me object to the form of the question insofar as it assumes that the bucket moved ten feet. The testimony was that the pole was ten feet from the truck. I think the question assumes a fact that has not been established.

Q. (By Mr. Ahl) Okay. Well, let's assume that the bucket was right next to the truck at the time -- or right next to the pole at the time. Would you have an explanation as to how that bucket moved laterally ten feet from where the pole is located to the rail on the side of the truck?

A. No, I don't.

Q. Would you agree that it would take a certain amount of energy to move that bucket ten feet laterally from an engineering perspective?

A. If we're assuming that the bucket moves without being controlled to move. You're talking about as a part of the accident sequence?

Q. Well, it fails and separates from the boom.

A. Okay.

Q. And we know that it's going to come down because of gravity; correct?

A. Yes.

Q. And if we assume the facts as I've laid

them out, that the pole is ten feet from the truck, the boom and the bucket were next to the pole, that means that when it separates from the boom, the platform separates from the boom, it moves also laterally ten feet before striking the truck. Agree with that? If all my facts are correct?

A. I'll go along you.

Q. Okay.

A. I don't think it has any bearing on what I'm doing, but I go along with what you're saying.

Q. Why don't you think it has any bearing on what you're doing?

A. Well, I -- I mean, that's not what my purpose of this is. My purpose was to look at the fracture and determine why the bucket broke. I just haven't participated in any reconstruction efforts.

Q. Okay. Would it tell us something about maybe a load that was placed on the bucket that would create enough energy to move that bucket laterally?

A. Maybe.

Q. Can you think of any other method by which that energy would be present if that bucket moved ten feet laterally to hit the truck?

A. I haven't considered that. I -- I have looked at that dent in the channel in the truck. I

don't know that that's the result of the bucket hitting it any more than I know the red paint on the bucket is from impact with that. The whole truck's red. You could get red paint on it any number of ways. But I don't know about your scenario.

Q. Okay. I understand. I just want you to assume that it's accurate. I'm just wondering if you have another explanation for the energy that it would take to move that bucket laterally ten feet from the pole to the place where, if we assume that it hit the truck, it hit the truck?

A. Right. I guess what you're asking me is, is there a side load enough that would make it bounce off the pole. If it's hung up on the pole, will it bounce back. I don't know the answer to that.

Q. Okay.

A. And it doesn't matter to me either way.

Q. It would be important, though, if we were trying to determine potentially what load was on this bucket at the time of failure?

A. It's one consideration that a person reconstructing would have to account for.

Q. Okay. You did a second report that is dated August 29th of 2016.

A. Yes, sir.

Q. And in looking that -- at that report, I don't see any new opinions or conclusions that you have arrived at since your original report. Am I correct or am I wrong?

A. You are correct.

Q. Okay. And, again, since Mr. Eihusen has become involved and you shipped the bucket back to Nebraska, the only thing that you did was make your observations macroscopically and microscopically when you were provided with the samples of material from California?

A. There you go again trivializing what I've done on this case.

Q. Well, correct me, then. What else?

A. It wasn't trivial. It's the cornerstone of a failure investigation, is looking at a fracture.

Q. Well, but correct me if you've done things other than that. Whether it's trivial -- trivial or not, we'll let somebody else decide.

A. I just want to make sure you understand my opinions.

Q. Oh, I'm giving you all the credit in the world.

A. So I haven't done any additional laboratory work other than look at those

cross-sections since I've had them and take photographs of those.
Q. You still have them?
A. **I do.**
Q. Okay.
A. **The rest of this work are things that have been provided to me since my report was originally authored.**
Q. Anything -- you've been given a copy of Ben Railsback's report?
A. **Yes.**
Q. Anything in there that you're critical of?
A. **I haven't gone through it in such excruciating detail that I could say I agree with assumptions that are made and the bases for arriving at a conclusion of reconstructing the accident. I just haven't done that.**
Q. Okay.
A. **I do think that the side loading issue, even if it's out there, wouldn't be an issue had there not been a problem with the structure itself. It would be able to handle side loading. There's even a side loading criteria.**
Q. It would be able to handle a side load

regardless of how much that load was?
A. **It would be able to handle -- it should be able to handle every foreseeable side load in service and survive. That's why they're overdesigned. So if there's a flaw in there, they don't behave that way, that's the material or the product's problem.**
Q. I understand. But there's always design limits, aren't there? And people can abuse or overload any product they want to, can't they?
A. **Yes, they can.**
Q. Okay. You were provided a copy of Dr. Rakow's report?
A. **Yes.**
Q. Anything in there that you're critical about?
A. **I disagree with his conclusions for the same reasons we've already talked about.**
Q. Which conclusions?
A. **Well, I think that there are -- there are -- the defects that are present in this structure are benign flaws, I don't agree with that. I think the fracture and this occurrence demonstrate cleanly otherwise. I also disagree with the assumption that because there are a few of these he's looked at out**

of 9,000 and those have delaminations in them, that you can write off and say, all these are good, it doesn't matter how many defects are present because they all have them. That's a reckless approach at analyzing a failure.
Q. Do you know how many of these buckets have actually failed in service in the last 20 years?
A. **I would -- I would estimate very few. I don't know how many have failed, but I wouldn't think a big population of them fail.**
Q. Do you know if Dawson ever had one fail before in their use of them?
A. **I don't know. I've seen buckets fail.**
Q. I'm not asking you that. I'm asking you about Osborne platforms.
A. **I don't know.**
Q. Okay. And you don't know how many of them would have had this same condition that you've described as being the defective condition?
A. **I don't know.**
Q. Okay.
A. **No one will know that.**
Q. Okay. Do you intend to do any additional work or formulate any other opinions or conclusions as part of your work?

A. **I anticipate reviewing depositions as they're taken. Maybe even attending them of the various experts. If there are other depositions that are taken, I expect to be asked to review those as well. There may be other lab functions that -- that arise upon reviewing those depositions or hearing what people have to say. At this point, we haven't really discussed it. I don't expect my opinions to change. I expect them to be enhanced if there's more invasive work done. But we haven't really talked about that.**
Q. Okay. I'm assuming that you charge for your services by the hour?
A. **Yes, sir.**
Q. What's your hourly rate?
A. **295.**
Q. Okay. Do you know approximately what your bill has been so far for the work that you've performed in regard to this analysis? A ballpark figure is close enough for me.
A. **Good. Because that's -- that's all I can do.**
Q. That's all we need.
A. **It's less than probably $20,000 over the last four years.**

MR. AHL: Okay. I think that's all the questions I have for you today. I'm going to let Mr. Shively ask a few. Okay?

THE WITNESS: The duck hunter.

MR. AHL: Correct. So watch out for him. He's deadly.

MR. SHIVELY: There's no movie called that, that I know of.

THE WITNESS: Are you saying you don't hunt deer?

MR. SHIVELY: That's true. That's correct.

THE WITNESS: Nor do I.

MR. SHIVELY: If it flies, I hunt it.

CROSS-EXAMINATION

BY MR. SHIVELY:

Q. Mr. Coleman, I'm Bob Shively, as you know. We met just prior to the deposition, and I represent Altec in this case. And we, with your report dated September 30th of 2015, were given your vitae at that time. And I just want to make sure it's current. Have you updated it or revised it since September 30th of 2015?

A. No.

Q. Is it missing anything that you think

should be added?

A. I don't know. I get so tired of doing that stuff, I just don't pay attention to it.

Q. And I don't blame you. But specifically, for example, with regard to publications, the vitae we have has the last publication you authored being in, I believe, 1980?

A. Long ago.

Q. Okay. Nothing new in recent years?

A. No. There are no papers involving buckets.

Q. And would that also be true with regard to lectures and unpublished presentations? Nothing new that's not on your vitae?

A. I don't know. I don't think so. There have been so many publications -- or presentations. But those are -- those are small group things. Not with respect to anything in this case. Mostly oil field equipment.

Q. And we have a 2015 fee schedule. I assume you updated that in 2016?

A. Yes.

Q. Because in 2015 the rate was 265. I assume you raised it in 2016 to the 295 that you testified to?

A. I think so. I don't know when I did that.

Q. Can you think of any other changes in the fee schedule from the 2015 one?

A. Oh, I'm sure Phil Perkins' rate has changed. And there may be a change in some of the specials below it. But really it's pretty close to the same.

Q. Had you ever done any work on behalf of Dawson Public Power prior to this case?

A. No, sir.

Q. And that would be work in any regard: consulting, forensic, litigation?

A. No.

Q. How about do you know who the insurer for Dawson is?

A. No.

Q. Had you ever worked with Mr. Guenzel's firm prior to this case?

A. No.

Q. And how about Mr. Beucke's firm?

A. No.

Q. Mr. Ahl was questioning you about two reports that we've received, the first one of September 30th of 2015 and the second one of

August 29th of 2016. Do you understand that?

A. I do.

Q. And in your August 29th, 2016, report you refer to the review of engineering literature and technical publications. Do you recall that?

A. Of course.

Q. When did you review those in connection with your work in this case, approximately?

A. A specific date, I couldn't tell you, sir.

Q. Well, I notice that it's -- you didn't list any such review of materials prior to your -- or in your report of September 30th of 2015. You do list them in your August 29th, 2016, report. Can we infer from that that you reviewed those materials after your September 30, 2015, report?

A. Maybe I looked at them again. Those -- most of those publications came out of my existing library. Others came out later. I don't know when was -- which was what.

Q. And so specifically the publications that you list in your August 29, 2016, report, do you know where you got those?

A. A couple of these I've had. Another couple came from -- I think Mr. Eihusen sent a

couple. I don't remember which is which. And I can't say that I can, with great precision, recall a lot of -- most of these papers.

Q. I understand. So the -- at least a couple of them you think you got from Mr. Eihusen; correct?

A. **Yes.**

Q. With regard to Mr. Eihusen, have you ever met him?

A. **I met him yesterday.**

Q. Did you ever have any conversations with Mr. Eihusen about his work on this case, opinions and methodology, anything he's done, prior to yesterday?

A. **Yes, sir.**

Q. Okay. When did you first visit with Mr. Eihusen?

A. **I think it was when he was first brought on board by Mr. Guenzel and Mr. Beucke. I don't know when that was. Within the last, you know, year sometime. And then I spoke with him once on one other occasion.**

Q. The first conversation that you've told me about, what do you remember about it?

A. **My recollection, foggy as it may be, is that we discussed some of the problems associated**

with manufacturing this type of good. Particularly with -- with resin transfer molding. The types of defects that may be present. And I think -- and I also think he was -- had just looked at the bucket for the first time. So he may have had questions for me about -- about things, too.

Q. So the defects you just referred to, are you talking about in the manufacturing process?

A. **Yes.**

Q. And then the second conversation you had with him?

A. **A little bit more substantive, as I recall. And it was about opinions and conclusions in the report, my report. We discussed the structural components of the bucket and the failure mode. That's about it, I think.**

Q. Did he share with you what he thought caused the failure?

A. **I'm sure he did at the time.**

Q. Anything stand out that you disagreed with each other on anything?

A. **I wouldn't call it disagreement. I would say that his efforts were focused in another area more so than mine. He was more associated with analyzing the bucket structure, inspection techniques**

and those sorts of things. And I wasn't really involved with that.

Q. And you remain not involved with those things today; correct?

A. **That's not my -- I mean, I'm not a structural mechanics person. I think he has lived in that world so long, he's part of the fiber himself. And so, you know, we're crossing over different areas here.**

Q. To your knowledge, have you ever spoken to anyone affiliated with Altec about anything having to do with this case?

A. **No.**

Q. Have you spoken with any of the other retained experts whose reports you've read in this case?

A. **No. I've never met any of those three gentlemen.**

Q. In your report of September 30, 2015, you mention a yellowed area in the platform or bucket. Do you recall that?

A. **I do.**

Q. And does that have any significance to you, the fact that you found yellowed -- a yellowed area?

A. **Well, it's significant in the sense that it's at the origin and it appeared to be a foreign material in the corner and in another component. And it was inconsistent with the appearance of the remainder of the cross-section.**

Q. In what way?

A. **Well, it's yellow, first of all. But because it also seems to be associated with -- or I would call it a heterogeneous area. In material sciences, that means an odd zone, a bad zone, a defective zone, an area of weakness that's concentrated around an impurity or some other substance.**

Q. Do you have an opinion on what might have caused the yellowed area?

A. **I think that there are different explanations for it. I don't know which is the right one. There are issues with curing. There are issues with bleeding solvents. You know, chemical inconsistencies. And laminations and voids and other things which provide the source of a crack or some other microscopic flaw or macroscopic flaw. I don't know what the yellow can be attributed to, and it hasn't been identified cleanly yet.**

Q. Whatever possible cause of that would be,

would it have been during the manufacturing process?

A. I'll take your question to mean this: It isn't something that occurred after the failure. It is not a result of exposure to the air. It's an inherent part of the component. It's not weathering or oxidation that occurs after a failure.

Q. You've also referred to foreign materials. Did you ever identify specifically what foreign materials were in the fiber of that platform?

A. No. I've not had a chance to do that, and I understand that was part of the exercises in California that were inconclusive as well. The one thing we do know is that it's at the origin and that it's not supposed to be there. We just don't know what it is.

Q. Do you know whether it -- or do you have an opinion on whether any foreign material actually contributed to the failure or caused it?

A. I have to leave it at something being inhomogeneous. I can't tell you if something was entrapped intentionally or, you know, a piece of something was entrapped in a mold. I don't think it's necessarily that. I think it's a consequence of injecting the mold, curing, and some compound reactions.

Q. With regard to your conclusions and opinions, you have given us the opinion that there were inherent manufacturing defects in the man lift bucket; correct?

A. Yes.

Q. Do you know who manufactured the lift bucket?

A. It's my understanding it was Osborne in Kansas.

Q. Are you aware of any involvement of Altec in the actual manufacturing of the lift bucket?

A. I think Altec is the designer, not the fabricator. As I understand it.

Q. That's your understanding?

A. That's what I know.

Q. You're not aware of any machining that was done by Altec; correct?

A. I don't -- I don't know about that. There has to be machining done on this, but I don't know who would have done it. I would think that would be done at the principal place it was fabricated.

Q. And so with regard to your third conclusion and opinion where you state the defects were present at the time the man bucket left the

control of the manufacturer, were you referring to whoever manufactured the lift bucket itself?

A. Yes.

Q. You're not offering any opinions with regard to the design of the bucket and any effect it had on the cause of the failure?

A. Not so much in the -- in the actual design on paper. I'll offer this: If there is a problem with these buckets, it's that the defects are hidden from not just the users' view, but the inspectors' view. So in the chance that there are a cluster or a highly populated area of the bucket that is -- let's say, started out badly, meaning from manufacture, or weakened during service because of residual problems in the melt, those defects remain concealed to those people.

I've also seen no life expectancy for these buckets and no way to know when the bucket should be retired from service other than just visually looking at it. And I think that's good for lots of occasions, but when there happens to be one that's made poorly, those things go undetected.

Q. The cluster of defects that you talk about, those would be unable to be detected when the product was new as well as after it had been used for

a period of time; is that correct?

A. That's true. That's one of the problems with composites and nonmetallic materials, is you're limited on the kinds of inspection methods that are available. Yes, there are some things you can do, but there are ghastly expenses, and they are very difficult to perfect. It does not mean that you didn't do it, but it's hard to do that in the field. Or at a customer's lab without bringing a unit to them. It's very complicated.

Q. The manufacturing defects you're talking about are on the inside, not visible to the naked eye; correct?

A. That's right. And maybe I need to clean that answer up a little bit. Hidden defects are the worst, because they can explode and give you a brutal, unwarned about, so to speak, failure. When the material is prone to deteriorating or weakening with time because of interactions inside as a part of the plastic, those things go undetected. But if you inspected later on down the line, you would know if the bucket material had deteriorated, cracked, oxidized, whatever else otherwise, and maybe have a better idea of when a bucket should be retired from service.

Q. The -- the defects you've identified in this bucket, would those have been visible at the time of manufacture?

A. Not necessarily. Some may. Some may not. And there's no way to know what the answer is in the middle. Because we don't know the propensity for internal cracking in these kinds of materials yet.

Q. What inspection at the time it left Osborne would have been detectable, if anything?

A. I don't know that you could find anything other than x-raying every bucket that you make. That seems impractical to me.

Q. And you're not aware of that happening in the industry, that each single bucket that comes in gets x-rayed; correct?

A. No, it does not. I would be shocked if that was the case.

Q. And the other way to find out would be cut into them; correct?

A. There are other ways to do testing. There are other ways that would permit you to find defects. For instance, if you were to use techniques like acoustic emission or some ultrasound methods, the presence of flaws in critical areas can be

detected. And certainly you could do that at the factory, but I don't know that people do that.

Q. Your conclusions and opinions in this case don't include anything with regard to inspections; correct?

A. That's right. Other than to say that there was no indication on the inspection in February before the accident occurred that there was no visible problem with the unit.

Q. And that inspection was done by Dawson; correct?

A. Yes, sir.

Q. And you're not offering conclusions and opinions with regard to warnings. That wasn't part of your scope of work. Correct?

A. No, it's not.

Q. I asked a poor question. It might look bad when we look at it later. I think I asked you is it correct, and you said no. But I assume your answer meant, no, you're not offering opinions on warnings as a cause of the failure here?

A. I think you asked a worse question the second time.

Q. I'm sure I did, which happens.

A. Let me make sure I understand what you're

saying.

Q. I just want to make sure you're not offering any opinions in this case with regard to deficient warnings, for example?

A. No. I am not offering anything on warnings. I've not been asked to do that. That's not my area.

Q. Not your area of expertise; correct?

A. No, it is not.

Q. You're not a safety expert. You're a materials and metals --

A. I could be because of what I've seen and what I've been involved with, but I don't like to do that. That's not my -- my thing.

Q. And you haven't been asked to do any of that in this case?

A. Not at this point.

Q. So your sole opinions that you're offering today have to do with the manufacturing defects; correct?

A. Yes.

Q. In your report of August 29, 2016, you indicate that you reviewed four depositions taken in this case?

A. Yes, sir.

Q. As we sit here today, are those the only depositions you've reviewed concerning this case?

A. That's all that I have.

Q. Okay. That was my next question.

A. I know. There you go.

Q. You're ahead of me. Most people are. The -- you haven't been provided any depositions other than those four; correct?

A. That's true.

Q. You reviewed the investigative report of Anand Shah. And he goes by Andy. Do you have any criticisms or disagreements with the report you reviewed of Mr. Shah?

A. Sure, I do.

Q. Okay. Go ahead and tell us about them.

A. He thinks I'm wrong. I think I'm right.

Q. Okay.

A. That's really what it boils down to. He attributes -- the one thing I do agree with him on is the origin of the failure at the junction between the rim and the rib, in that area, location "A." I agree with -- I'm glad to see that he agreed with me on that. He does not agree that -- well, what he said was, is that the delaminations are present and they're in all these things. So he says they're all

defective, basically. They all contain defects. Just most of them don't matter.

I think that's reckless. I think, much as your person or people that looked at this failure and Mr. Shah that looked at it said that they can tell by looking at it that it was overloaded, that's a pretty good test from their eyes as well, although without the scientific basis for it. I look at it and I can see the manufacturing defect. So in that sense, what I think is a defect and what Mr. Shah thinks is a defect are two different things.

Q. Can you think of any other criticisms or disagreements in his work?

A. I disagree with his statement that says that the -- because the fibers in the plastic are parallel to the crack, that shear location and damage are consistent with side loading. And he bases that off the test pattern of an Altec in-house test, I guess, in 2002. I don't think that that is indicative of side loading, necessarily. Just because what he says there, that the fiber is parallel to the crack. Fibers run all directions in these things.

He says the side loading is excessive. I disagree with that. And that it doesn't fail from

normal -- failure didn't occur from normal operating loads. I disagree with that as well. There's nothing that tells me that this is -- the use on this bucket, either beforehand or at the time of the accident, was something that created the defects. It may have exposed the defects, but the use was foreseeable.

And even if it was misused, that's the reason these things are overdesigned. Which all goes back to, with the failure as such and these things that are supposed to be so strong and occur at a low load, the defects must be the overwhelming cause and not the use. I disagree with his position on that.

I also agree with -- disagree with his statement -- and it may be semantics. But I disagree with the fact that there is no evidence to support that the extent and level at which the cracks are present are sufficient to cause failure. I think it's -- I think that's wrong. I think, yes, there are defects that can live in materials and not result in a failure. I think that's possible in metals, I think it's possible in polymers, and I think it's possible in composites. It's when the defects are located at certain positions that makes them erupt in service and cause a catastrophic failure, it's

important.

I think, secondly, that the defects may not be present necessarily at the moment the material comes off the product line, but because of the condition, the ongoing changing condition of polymers in general, is that cracking and deterioration can -- can happen in service. And, consequently, those defects become paramount in the performance of something like a bucket. So those are my disagreements with his report.

Q. And as you were testifying about Mr. Shah's report, you were actually referring to some handwritten notes you had in your file; correct?

A. Right. I do. There's two pages of them. And they are just paraphrased.

Q. Did you create similar notes with regard to your review of the reports of Mr. Railsback or Dr. Rakow?

A. No.

Q. Why not?

A. I haven't had time to do it.

Q. Okay. So you got to Mr. Shah's first. Is that a fair -- fair summery?

A. I did it last night. I just wrote them down by hand. I've read the reports. But I just

thought I better look at this because you're going to ask me. So I did, and I just didn't do the other two.

Q. You didn't get to Rakow's report or Railsback's report?

A. Oh, I read them. I've read them. I just didn't annotate them. This is just paraphrased. There's no opinions in these notes. I just highlighted a few pages and said, this is what they said on those pages.

Q. Okay.

A. And you get that, so...

Q. Have you ever spoken with anyone who has represented that they saw the actual bucket fall from the sky?

A. No.

Q. You don't have any knowledge specifically of what Mr. Keaschall was doing at the time of the failure?

A. I've only heard what he was up at the site for. I don't know what he was doing.

Q. At the specific time of failure; correct?

A. Right. I don't know.

Q. Have you ever worked, actually been employed, where you were up in an aerial lift bucket?

A. Employed?
Q. Well, have you ever worked doing that kind of work?
A. No.
Q. And during your earlier testimony, you made it sound like you've been in a lot of these buckets.
A. I have.
Q. That's what I want you to tell me about.
A. I've -- I've worked for many power companies.
Q. As an expert?
A. Yes, sir.
Q. Okay.
A. And I've been in bucket trucks many, many, many times.
Q. Have you actually run the booms --
A. Oh, yeah.
Q. -- yourself? Okay.
A. Yes, sir. Are you not going to ask me what I was doing? I'm going to have to tell you without you asking me?
Q. Sure. Go ahead.
A. Most of those cases involved power line failures. And electrocutions or fires that result.

And it's -- like I said, I do a lot of work for the power companies. So we're looking at splices, line failures. And many times that involves getting up in the buckets and looking at splices and where people shoot lines with shotguns. It's all defense work. There. I just had to say that.
Q. Mr. Ahl was asking you about instructions you may have given to the people at Dawson with regard to the bucket and any component parts or any parts of the bucket. Do you remember that?
A. Yes.
Q. And did you give Dawson any instructions with regard to the pole?
A. I don't remember specifically an instruction about the pole. I remember saying there are going to be other people that want to look at this. Keep it all and quarantine it. That's all I recall discussing. I don't think I saw the transformers or any other equipment that would have been taken out of service either.
MR. SHIVELY: I don't have any other questions.
MR. AHL: Do you have any? I have a couple more, but go ahead.
MR. BEUCKE: No. I don't have any.

MR. GUENZEL: I don't have any questions either.

REDIRECT EXAMINATION

BY MR. AHL:
Q. I have just a couple of additional questions that I forgot to ask you --
A. Okay.
Q. -- when we were first talking. Are you aware of any engineering or scientific testing that can be done in regard to one of these platform or lift buckets that we've been referring to, to find out where the stresses are on that bucket when they're loaded?
A. I'm sure it's been done. I would think that Altec probably has design folks that do that. That's how they would arrive at the size and shape and the materials chosen, I would think.
Q. And I can't remember the exact name of the test that I've heard. The finite...
A. Element analysis.
Q. Element analysis?
A. FEA.
Q. You're familiar with that process?
A. Yes, sir, I am.
Q. And what is that process designed to do?

A. It's designed to create a package of spots on an object where one can know exactly what the stresses are during operation or however else you want to do something.
Q. Okay.
A. That's the purpose. It's a tool in design.
Q. Okay. That process could be applied to one of these platforms to determine when it's in use, where the particular stresses would be in relation to the bucket; correct?
A. Yes.
Q. Did you do that in regard to one of these buckets?
A. No. I don't do finite element work.
Q. Okay. Do you think that would be important in this case, to find out where the stresses were on the bucket while it was being in use?
A. If you're evaluating the design, yes. I also think it's good to know what stresses are present where. And I expect that that would be something Mr. Eihusen can do. And there are a lot of people that do that. I just don't do it.
Q. When this particular bucket or a bucket

like the one that was being used by Mr. Keaschall was in use, do you know where primarily the stresses are located on the bucket?

A. **Well, there's stresses all over the bucket. But the heavy loading is up where the attachment points are.**

Q. Do you think the load is distributed generally across the floor --

A. **Well --**

Q. -- or not?

A. **-- let's -- I don't know that I can answer your question that way. Of course the bucket is going to hold whatever weight is standing in it or whatever tools are in it. And it's going to be transmitted back to the connection points, where the ribs are bolted to the assembly, to the truck. And that's the reason that -- and the stresses are highest there. That's the reason there's ribs, and that's the reason there's a thickened rim as opposed to the rest of the bucket.**

So you know the stresses are going to be bigger there. That's why it's beefier. And there are stresses that occur on other parts of the bucket as well, and defining what those are at specific sites, I haven't done that.

Q. Okay. Do you know whether that's been done as part of the investigation process in trying to determine what caused this failure?

A. **I don't remember seeing any finite element work.**

Q. Okay. You have, in your analysis, determined that the starting point for the failure was what we've determined earlier or have been referring to as location "A"?

A. **Yes. In that vicinity. That's true.**

Q. Have you determined whether or not while this bucket was in use location "A" would be a low stress point?

A. **I would think it would be a high stress point.**

Q. You would think that?

A. **Yes. Yes, I would.**

Q. And why do you think that?

A. **Because that's where it's attached.**

Q. At point "A"?

A. **Well, it's in that area. It's -- it's close to the area where the ribs and the rim are attached to the struc- -- to the truck. And it's not at the point, but it's near it.**

Q. It's well above it, isn't it?

A. **Oh, sure, it's above it.**

Q. Okay.

A. **But it's on the same side. I mean, it's not a little hinge. I don't mean that. I don't mean to discredit that. It's just on that side of the bucket where it's attached is where the loads are high. Of course, the loads get higher when you go from a big area to a small area. They're accentuated in those corners and curves and smaller areas, too.**

Q. So based on your analysis and your opinions and conclusions, your education, training and background, location "A" is a high stress area when that bucket is in use; true?

A. **Well, it's one of the areas. It's not the only area.**

Q. Well, I didn't say the only area. I said you consider it to be a high stress area when that bucket is being used?

A. **I do.**

MR. AHL: Okay. I have no further questions.

MR. SHIVELY: I have no questions.

THE WITNESS: I need to read and sign.

MR. BEUCKE: Yes, you do.

(Deposition concluded at 10:38 a.m.)

C E R T I F I C A T E

I, Marcy Benge, RMR, General Notary Public, duly commissioned, qualified, and acting under a general notarial commission within and for the State of Nebraska, do hereby certify that:

WILLIAM COLEMAN, M.S., P.E.

was by me first duly sworn to tell the truth, the whole truth, and nothing but the truth; that the foregoing deposition was taken by me at the time and place herein specified and in accordance with the within stipulations; that I am not counsel, attorney, or relative of either party or otherwise interested in the event of this suit.

IN TESTIMONY WHEREOF, I have hereunto set my hand officially and attached my notarial seal at Lincoln, Nebraska, this 7th day of December, 2016.

General Notary Public

AMENDMENT TO DEPOSITION

CASE: KEASCHALL V. ALTEC/OSBORNE

WITNESS: WILLIAM COLEMAN, M.S., P.E. ____No Changes

The witness herein states that he/she wishes to make the following changes in his/her deposition:

PAGE	LINE	NOW READS	SHOULD READ	REASON FOR CHANGE

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____
DEPONENT'S SIGNATURE

The signature above was subscribed and sworn to before me this ____ day of _________ , 20_.

____
GENERAL NOTARY PUBLIC

C

ANALYTICAL & MATERIALS ENGINEERING, INC.
1906 Atchison Drive
Norman, Oklahoma 73069
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September 30, 2015

EVALUATION

OF A

FRACTURED AERIAL LIFT BUCKET

In the mater of:
Julie Keaschall and Dawson Public Power District
vs
Altec Industries, Inc. and Osborne Industries, Inc.

Submitted to:

Mr. Steven E. Guenzel
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Guenzel & Widger
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Mr. Larry W. Beucke
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IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEBRASKA
CIVIL ACTION NO.: 4:14-CV-03070

As prescribed by:
Federal Rule 26(a)(2)

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EXHIBIT
D

INTRODUCTION

An employee of Dawson Public Power District, Mr. Kurtis Keaschall, was fatally injured as a result of a lift bucket failure on vehicle number #3505. According to reports compiled by Mr. Jeremy Kaiser and Mr. Dean Kunkee of Dawson Public Power, Mr. Keaschall was in the process of retiring hardware from a pole and was working the line de-energized. The set-up of Truck #3505 at the scene is described in their report of the June 6, 2012 incident. Two hand-drawn schematics of the accident locale provided a general layout around the pole. Another statement (approximately ½ page typewritten - author unconfirmed) by the co-worker who initially found Mr. Keaschall, indicated that the bucket was no longer attached to the truck. The accident reportedly occurred near Ravenna, Nebraska. The truck and associated equipment was subsequently taken to the Dawson Public Power District facility in Lexington, Nebraska.

Mr. Steve Guenzel of the Johnson, Flodman, Guenzel & Widger law firm in Lincoln, Nebraska, contacted my office by telephone on June 8, 2012, two days after the accident. We were engaged by Mr. Guenzel's firm shortly thereafter to examine (in Lexington) the truck and aerial lift assembly, and to determine the cause of the bucket failure.

EXAMINATION

The initial examination was conducted on July 13, 2012, a little more than one-month post-failure. Mr. Dean Kunkee, Mr. Jeremy Kaiser and Mr. Bob Heinz directed me to the vehicle. Dawson Public Power truck #3505 had been quarantined indoors at the Lexington facility since immediately after the accident. As a part of the inspection I examined the Model 7300 International truck and documented its condition photographically. The boom had been previously lowered from the bed controls and had reportedly remained untouched since the accident. The turret and bucket, including the detached segment on the ground nearby, were covered with a blue tarp. Additionally, the pole that Mr. Keaschall had been working next to was lying on the ground parallel to the truck. (Figures 1 through 20)

A template found on the boom base identified the lift assembly as a Model AA755L carrying the Serial No. 0405 BZ 3559. Altec Industries was noted as being the manufacturer or seller of the unit. On the left rear under rail an Altec Serial No. 37-3830626 07/05, was noted. Osborne Industries was also shown on the bar

coded sticker. "Initial Inspection Photographs of the Aerial Bucket" was submitted to Mr. Guenzel on May 6, 2013. The bound volume contained the 234 photographs (Figure 1 through 234) taken during the first examination. These included numerous photographs of the failed fiberglass bucket.

The portion of the bucket that had fallen to the ground is shown at the rear of the vehicle in Figures 3 and 4. Figures 26 through 31 reveal the flap of fiberglass remaining attached to the lift assembly, while Figures 48 and 49 exhibit side views of the flap of material. Additional perspectives of the fractured fiberglass are presented as Figure 56, and Figures 58 through 62. A partial overhead view of the area is shown in Figure 66, with additional views provided as Figures 67 through 72. Overall views of the large bucket segment, plus a series of close range photographs, are shown in Figures 73 through 89. Close up images of the fiberglass flap are exhibited in Figure 90 through Figure 110.

Macro-photographs displaying the upper portions of the fractured flap are provided in Figures 112 through 141. These are taken of the area around the perimeter of the bucket nearest the control panel, the thickest section and the area containing the vertical platform ribs. In Figure 147, slightly below the center of the image, a yellowish fractured region stands in obvious contrast to the adjacent whiter fiberglass. Close up views of this area are disclosed in Figure 148 through Figure 152.

Another view of the failed bucket is shown in Figure 154, followed by an overhead view in Figure 155. The roughly triangular-shaped white piece near the upper end of the photograph is a small piece of the fractured bucket. An oblique view revealing one side of the fractured perimeter appears as Figure 156 (in Figure 154, the area is about one-third of the way along the edge from the right corner). Figures 157 through 163 offer extreme close up images of the fractured bucket rim, with Figures 159, 162 and 163 demonstrating the most unobstructed views of the fracture. Un-bonded (yellowed) areas are visible, as are horizontal dark streaks of contaminated laminate. These are primary fracture origin sites. Figures 170 and 172 illustrate the fracture on the facing segment of the bucket perimeter.

Figures 190 through 196 are overall and mid-range views of the bucket liner. Additional overall and close range views of the failed fiberglass bucket are presented as Figures 197 through 207. Views of the pole are provided in Figures 208 through 221. Dawson personnel removed the fiberglass flap, with the fractured piece exhibited in Figures 222 through 226, and Figures 228 and 229.

LABORATORY EXAMINATION

The entire bucket, including all fragments and the liner, Altec was shipped from Dawson Public Power to our laboratory in early August 2012. Laboratory examinations of the fractured bucket and its fragments were conducted shortly thereafter and periodically over the next few months. Macro-photographs documenting the condition of the bucket were taken, and submitted on May 14, 2013 to Mr. Guenzel and Mr. Larry W. Beucke, co-counsel for the plaintiff. Both sets of examination photographs are folded into this report in their entirety. The second volume of photographs contains 23 additional images (Figures 235 through 258). Figures 239 and 253 provide additional views of an area exhibiting a fracture origin.

Only non-destructive examination and study of the fiberglass bucket was conducted while the evidence was in our possession. The entire bucket and fragments were shipped via FedEx Freight to Mr. Guenzel's on June 25, 2015.

QUALIFICATIONS

I have a Bachelor of Science and Master of Science degrees majoring in Metallurgical Engineering from the University of Oklahoma. I completed a substantial additional post-graduate work toward the Doctor of Philosophy degree, majoring in Metallurgical Engineering and designating Analytical Chemistry as a minor field of study.

During the traditional academic calendar beginning in August 1989 and continuing through May 1996 I served as an Adjunct Professor in the Department of Chemical Engineering & Materials Science at the University of Oklahoma. My primary responsibilities included teaching courses in metallurgical engineering and the materials sciences, in addition to advising undergraduate students. Among the courses I taught during that time were: (1) Structures and Properties of Materials, (2) Physical Metallurgy (ferrous and non-ferrous alloys), and (3) the companion Physical Metallurgy Laboratories, plus (4) Failure Analysis & Materials Selection. The first course listed was an undergraduate core course required for the majority of the engineering disciplines within the College of Engineering. The latter courses were departmental and offered to undergraduate and graduate students majoring in engineering.

Throughout the years I have also taught courses to industrial interests and at the Oklahoma Center for Continuing Education. The recurring topics presented have been: (1) the principles of engineering, (2) basic metallurgy, (3) the theory of the heat treatment of steels and non-ferrous alloys, (4) corrosion engineering and (5) engineering failure analysis.

Analytical & Materials Engineering currently specializes in the analysis of engineering failures. Primarily our work involves evaluating the in-service behavior and overall performance of many different engineering materials, devices and equipment. For example, on- and off-road heavy-duty automotive equipment such as tractor/trailer suspension members, braking components, frame rails, cranes and man lifts are often examined as phases of particular projects. Routinely we examine scores of different steels and non-ferrous alloys (i.e., aluminum, copper, and alloys of each). Polymers (plastics), ceramics and composite materials are among the other engineering materials that are evaluated.

Frequently the work may also include assessment of the materials, methods of manufacture and workmanship associated with fabrication of the product. Assessment of the design criteria and how those elements have been incorporated into the development, production, and inspection of a device may also be conducted. The analysis of previous field failures, re-testing and/or recertification of existing design and fabrication techniques may be performed as well.

Significant portions of our projects involve analyzing material failures associated with the oil and gas industry. On nearly a daily basis we are immersed in the investigations of drill pipe, casing and tubing, tubular connections and numerous downhole devices. Included also are rig assembly, disassembly and relocation. The steady diet of working on such products has resulted in extensive expertise in various oil field operations.

Our clientele consists of various local and regional industrial concerns, insurance companies and claims adjusting groups, private businesses, attorneys and law firms. Attorneys representing both plaintiffs and defendants frequently retain our services as consultants, and we favor neither litigating party.

My education and professional experience are itemized in the attached curriculum vita. A list of the cases in which I have testified by either deposition or trial appears in a spreadsheet, which is attached along with a fee schedule for Analytical & Materials Engineering. Currently the hourly rate for all phases of

engineering services is $265.00. No surcharges or variable rate structures exist for appearance at deposition or trial. My qualifications as an expert witness regarding metallurgical or materials issues, engineering principles, mechanical design and engineering failure analysis have been recognized in State and Federal Courts in Oklahoma and Texas, among other jurisdictions across the United States. I have not authored publications in the last ten years.

MATERIALS REVIEWED

As a part of the evaluation in this matter, I have been provided a number of documents for review and consideration. I have also consulted other publications, textbooks, and technical literature.

Dawson Public Power – misc. notes, sketches, scene photographs
Consolidated Fleet Services – Report of Inspection: 02/15/2012
Universal Inspections, Ltd., 8-17-11
Universal Inspections Ltd., 2-16-11
Universal Inspections, Ltd., 8-10-11
Universal Inspections, Ltd., 8-10-10
Universal Inspections, Ltd., 2-17-10
Altec Maintenance and Parts Manual
Altec Operator's Manual, AA755L
"American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices", ANSI/SIA A92.2 – 2009
"American National Standard for Boom-Supported Elevating Work Platforms", ANSI/SIA A92.5 - 2006
Interrogatories to Plaintiff Julie Keaschall
Altec Fiberglass Platform Construction - Procedure Number: EN-241-P (Origin Date: 05-22-86; Revision Date: 01-28-14) 0100003 - 0100098
Altec Correspondence 16 December 2002
Altec Test Report TR-00141, Platform Test, 12-13-02
Altec Test Report TR-00741, Platform Test MYR, 05-01-09
Altec Test Report TR-00741, Altec Composites Platform Test MYR, Revised 04-01-09
Altec Test Report TR-00822
Altec Test Report TR-00835
Altec Test Report TR-00848, West Platform Rib Issue, 03-08-10
Altec Test Report TR-01075
Osborne Line Resin Mix QC Test Record (1 p)
Osborne Purchase Order Status Report (22 pp)

AEM Aerial Devices Safety Manual
Altec Self Directed Sentry Operator Safety
Altec Build Records
Drawing 704-00065
Drawing 704-0350
PUN 201A, Secondary Lanyard Attachment
Altec Service Records
Osborne Discovery Responses to Request Nos. 2, 3, 7, 13, 21, 30, 31, 35, 37, 39

CONCLUSIONS and OPINIONS

Based upon macroscopic and laboratory examination of the evidence vehicle, lift assembly, fiberglass man lift bucket, the materials and documents reviewed, my education and work experience, I have developed the following opinions and formed the following conclusions to a reasonable degree of engineering certainty.

(1) Inherent manufacturing defects have been discovered in the subject Altec/Osborne man lift bucket. These defects include foreign material and zones of incompletely cured resin, resulting in specific planes of weakness. Fracture of the bucket can be traced directly to the region(s) containing these flaws.

(2) The fabrication defects, which are primarily sub-surface, precipitated fracture and premature failure of the fiberglass man lift bucket. Fracture could have been instantaneous or progressive, perhaps both. Neither scenario would have provided a warning of impending failure.

(3) The defects were present at the time the man bucket left the control of the manufacturer. In all likelihood, the defective condition would have been (a) undetectable during customary periodic (maintenance) inspections and (b) completely concealed to the end-user.

(4) No indications of pre-existing damage that could have adversely affected performance of the man lift bucket, were observed.

(5) The decedent, Kurtis Keaschall, neither caused nor contributed to failure of the man lift bucket.

It is highly likely that I will be asked to review additional reports, deposition transcripts and other discovery materials. To the extent that any information should affect my conclusions and opinions, I reserve the right to make appropriate amendments in a timely fashion with a supplemental report.

Respectfully submitted,

William R. Coleman

William R. Coleman, M.S., P.E.
Consulting Metallurgical Engineer

GUENZEL_keaschall.rep

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August 29, 2016

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RE: ***Julie Keaschall v Altec Industries, Inc. and Osborne Industries, Inc.***
IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEBRASKA
CIVIL ACTION NO.: 4:14-CV-03070

Gentlemen:

I have conducted additional evaluations of the design, manufacture and performance of the man-lift bucket associated with the above referenced matter. This supplement is to be incorporated entirely into my earlier report, published September 30, 2015. As a part of the work, I have reviewed the following engineering reports and deposition transcripts:

Expert Report, Joseph F. Rakow, Phd, PE	June 2016
Investigative Report, Anand R. Shah, M.S., M.B.A. P.E.	June 27, 2016
Engineering Report, Ben T. Railsback, M.S., P.E.	June 23, 2016
Failure Investigation Summary, John A. Eihusen, PE	Sept 26, 2015
Deposition: George Eakin (Osborne)	Feb 17, 2015
Deposition: Amy Conrad (Osborne)	Feb 17, 2015
Deposition: Michael David Moore (Altec)	Apr 2, 2015
Deposition: Ryan McKinney (Altec)	Apr 2, 2015

Specimens removed from the subject bucket during inspections and testing conducted by other parties have been examined in the laboratory. Macro- and microphotographs have been taken of the pieces made available and will be provided under separate cover. I anticipate conducting additional examinations of the

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remaining members and fragments of the failed bucket. Photographs acquired during such examinations will be distributed accordingly.

Finally, I have reviewed and studied engineering literature and technical publications related to the materials, mechanical properties and behavior of the fiberglass bucket involved in this case. Some of the publications are listed below.

Chui, WK, Glimm, J. and Tangerman, F.M., Modeling of Resign Transfer Molding, (unk)

Bunsell, A.R. and Renard, J., Fundamentals of Fibre Reinforced Composite Materials, Briston: Inst. Physics Pub, 2005

Hamidi, Y.K., Aktas, L. and Cengiz Altan, M., Formation of Microscopic Voids in Resin Transfer Molded Composites, Trans ASME, 126, Oct 2004, 420-426

Sutherland, H.J. and Mandell, J.F., Updated Goodman Diagrams for Fiberglass Composite Materials Using the DOE/MSU Fatigue Database, Contract DE-AC04-94AL85000

Steckel, G.L., and Hawkins, G.F., The Application of Qualification Testing, Field Testing, and Accelerated Testing for Estimating Long-Term Durability of Composite Materials for Caltrans Applications, 25 Feb 2005, CA DOT Contract 59A0188

Jollivet, T., Peyrac, C., and Lefebvre, F., Damage of Composite Materials, 5th, Fatigue Design Conference, Fatigue Design 3013

Additional examination and review of the evidence components, reports and technical materials have not resulted in significant modifications to my original conclusions and opinions.

It is my understanding that a number of depositions will be taken as discovery nears completion. To the extent that any information uncovered upon review of those documents should affect my conclusions and opinions, I reserve the right to make appropriate amendments.

Respectfully submitted,

William R. Coleman, M.S., P.E.
Consulting Metallurgical Engineer

Keaschall Failure Investigation

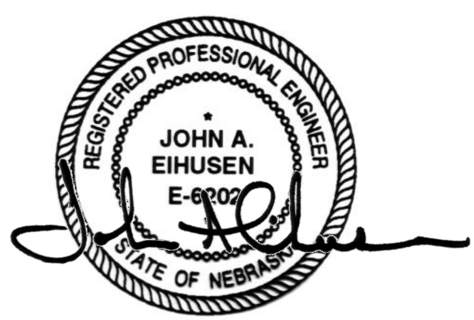
Consolidated Response to:

Ben T. Railsback, Knott Laboratory, LLC

Anand R. Shah, Engineering Systems, Inc

Joseph F. Rakow, Exponent Failure Analysis Associates, Inc

August 1, 2016



MECHANICAL

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John A. Eihusen, PE

1 Scope of Work

The scope of work (SOW) for this report is to provide expert review of the following reports as it relates to the physical evidence relevant to the Keaschall Failure Investigation.

a) Ben T. Railsback Knott Laboratory, LLC, June 23, 2016
b) Anand R. Shah, Engineering Systems, Inc
c) Joseph F. Rakow, Exponent Failure Analysis Associates, Inc

2 Standard Reference Datums and Identification

For consistency in this report a standardized reference datum is defined as an observer would view the assembly standing at the point of connection with the lift boom; facing outward and bucket open upwards.

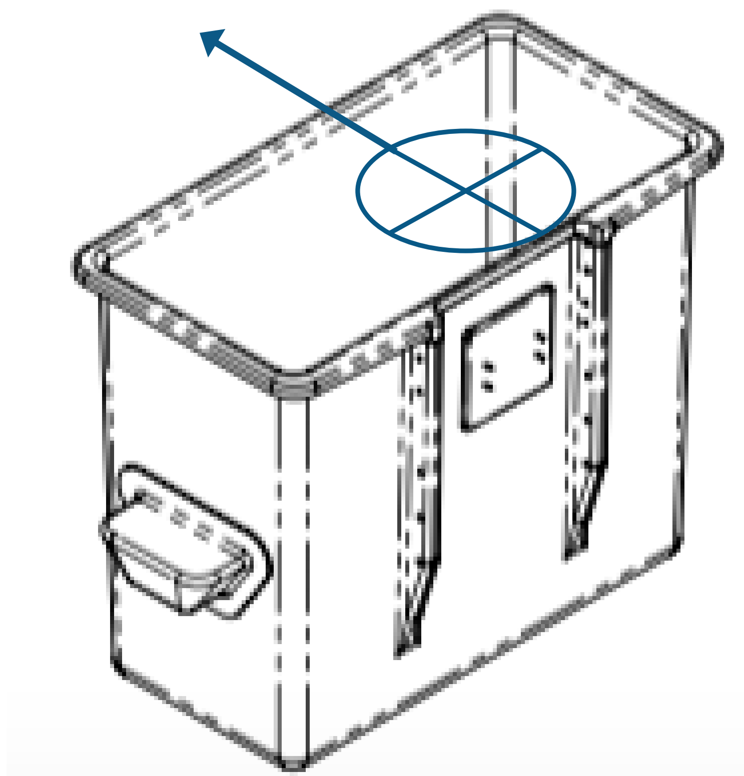

Figure 1 Reference View

Figure 2 Failure Locations

3 Commentary on Knott Laboratory Reports

Commentary and interpretive discussion of key evidence is provided as follows:

3.1 External Condition of Bucket Flange

In Figure 6(page 10) indentations on the bucket liner and bucket are noted as “old” and not part of the direct cause of the accident. This can be positively evidenced by the dark oiling, staining, and dirt that show an aged condition. The damage noted was not caused at the time of the bucket failure. It is also to note that Mr. Railsbeck indicated no positive identification of mating contact by direct comparison of the impacting surfaces using witness marks.

The bucket liner was fabricated from a low durometer insulative material and was doing its job exactly as designed, which was to protect the surface electrical characteristics of the bucket. Being a low durometer material (soft plastic) blunt edged tackle, tools, materials and even boots could register that class of damage. In fact this type of damage would be the reason to use a bucket liner because of this type of normal wear. As expected for tools and other dunage hauled into the bucket by human ergonomics it would be unreasonable to expect that any “man-rated” and “life critical” structure could be rendered unsafe by normal use.

As stated in other reports there was no published visual inspection criteria that would have warranted removal of this particular bucket from service. This is recorded by several independent inspection agencies in the disclosures.

3.2 Bent Wrench

In Figure 7 and 8 (page 11) the discussion was focused on a “bent” wrench. I find it highly unlikely that the axial misalignment highlighted was causative to any recorded evidence in the failure investigation. The standard drive spindles are purposely-fitted with an engineered class of free running, clearance fit between the drive pintle and tool receiver. That is what makes them useful as the end effector (driven tool) can be easily changed from the power drive. With normal use of impact drivers, the interface between the drive pintle and mating tool is peened open further widening the clearance gap.

The picture is simply a power tool with a large socket hanging off the end.

This fact can be evidenced that no tool was retired or replaced after the accident.

3.3 Paint indication – Pole

In Figure 12 (page 15) Mr. Railsbeck makes note of 2 alleged marks on the pole. Again, physical inspection of the pole as provided in Coleman’s photographs Figures 208 through 221 do not show any associated paint transfer or indentation. It is important to note that no expert on-site at the time of the accident or since has indicated a paint transfer to the pole. The surface indications again seem normal to the expected transportation, storage and handling of a rough timber power poll. The indications if involved in the accident would be clearly denoted by a paint transfer if the high impact loads contemplated by Mr. Railsbeck were truly imparted.

3.4 Failure Kinematics

In Figure 18 (page 20) and the following discussions Mr. Railsbeck failed to consider the evidence contained in the failure surfaces of the composite laminate and in no case did he incorporate the physical evidence of the failed laminate in his conjecture of the failure sequence. This is first evidenced in his discussion suggesting the failure of the laminate occurred simultaneously dropping the bucket straight down therefore ruling out the rotation of the bucket as insufficient to strike the truck railing.

My evaluation of the bucket rotation was not based on the kinematics of a free falling body, but on the fracture paths and the physical evidence retained in the composite laminate. I clearly indicated in my opinion the progressive nature of the failure from the primary point, the initial high-speed propagation of the fracture, and the hesitation and final failure events. The composite clearly demonstrates a rotational axis or hinge axis as shown in Figure 3 and Figure 4. This was the final coupling point between the boom and bucket as it failed. The laminate at this point was the last to separate; this hesitation in the speed of the failure (or fracture) is what imparted a rotational velocity to the bucket before the separation from the boom. The effect would be similar to cutting the string of a pendulum in mid swing. In that simple case the pendulum weight does not fall straight down but moves tangentially to the rotational path. Given the rotational momentum imparted to the bucket at the final release both Mr. Keaschall and the bucket would continue a tangential path at the time of separation and remain rotating as two free bodies in the same inertial reference frame.

If attention is drawn to Mr. Railsbeck Figure 16 (as shown below in Figure 5) in which he locates the bucket in relation to the impact point on the truck rail, the nominal axis of rotation can be mapped from the evidence recorded in the laminate. The nominal projected rotation axis shows good agreement to his presentation. As used here the term "nominal" rotation axis is used because the release of energy from the boom as the bucket and Mr. Keaschall's weight is shed will cause relative motion and generate minor errors in the actual placement of the separation axis.

Figure 3 Location Hinge Axis in the Laminate-Outside View

Figure 4 Location Hinge Axis in the Laminate-Inside View

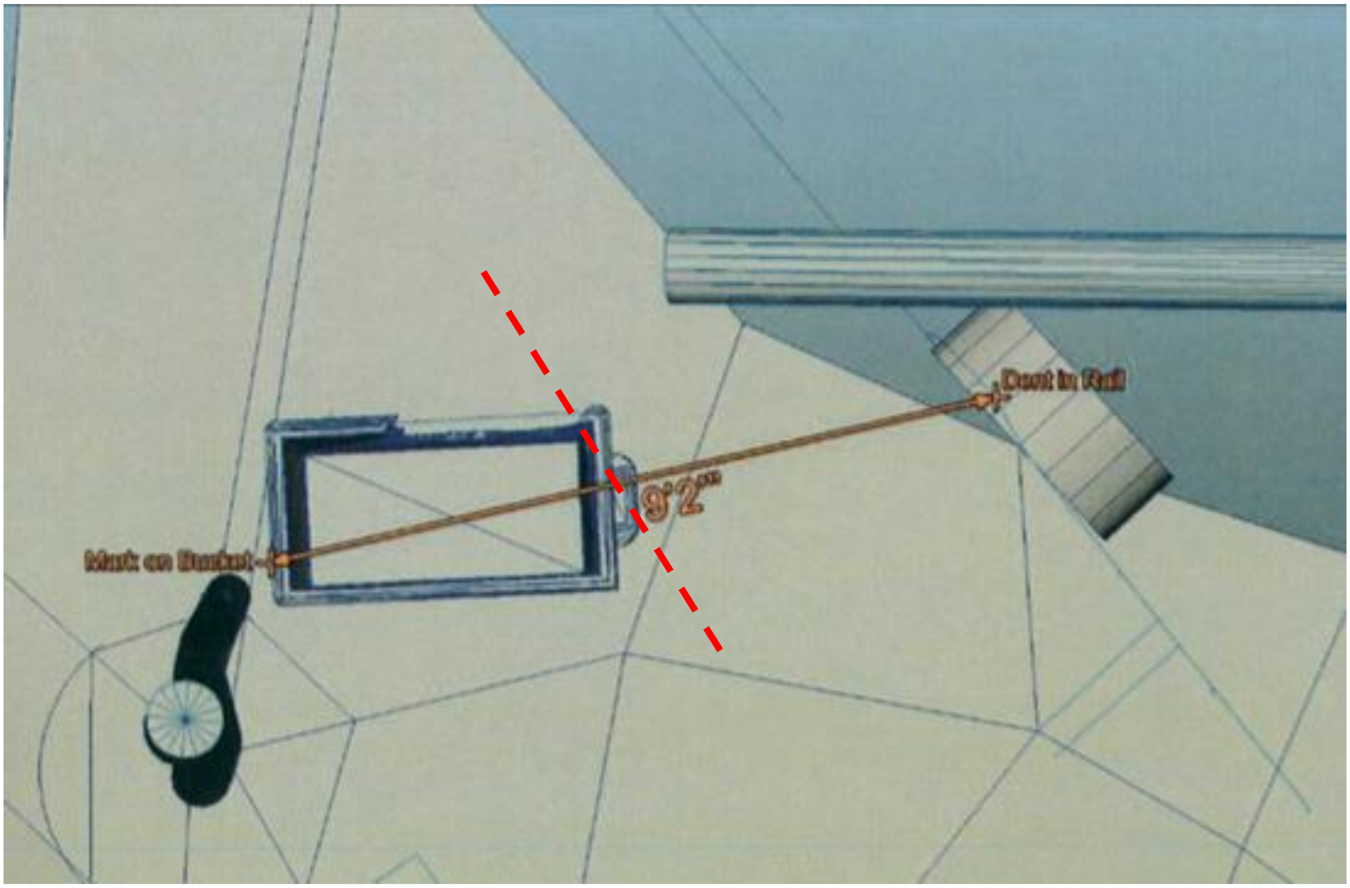

Figure 5 Nominal Location Hinge Axis Relative to Rail Impact Point

3.5 Pole Misalignment

Mr. Railsbeck makes a conjecture that the boom pushed on the pole resulting in a 10 inch lean away from the truck. Movement of the pole would have certainly involved displacement of the dirt at the base of the pole and been well observed by operational and safety experts on scene at the time of the accident. The condition of the dirt can be satisfactory observed as shown below in Figure 7. There are no indications of disturbed soil or plant placement.

It is more reasonable to consider that the pole was leaning because it was simply old and located in a bad position in the side of an embankment.

It is also reasonable to consider that Mr. Keaschall expertly placed his equipment in the best possible position to manage any risk from a potentially unstable pole, such as one with a noticeable lean with the support cables cut.

Figure 6 Utility Pole at Site

Figure 7 Utility Pole Base

3.6 Comment on Damage at Failure Location A

It is clear from the inspection of the laminate at Figure 8, the composite laminate was pulled rearward and outward from the center of the bucket as would be expected for the structure supporting Mr. Keaschall's weight. For an impact forward of the mounting bolts, this location would show material pushed or sheared forward into the bucket. The composite direction of failure suggests that the impact would have to have occurred behind the mounting bolts or between the lift boom and bucket structure. This is not a reasonable scenario based on the evidence.

Figure 8 Utility Pole Base

3.7 Comment on Bucket Location

In Mr. Railsbeck's Figure 16 the projected location of the bucket on the boom shows it clear of the pole. It is reasonable to conclude that the boom stopped moving at the time of an alleged impact if nothing more than Mr. Keaschall would not be able to operate the controls. It is highly probable that the boom recorded the placement of the bucket at the time of failure. Providing the positioning as described by Mr. Railsbeck an impact could not have caused the root cause of the composite failure sequence.

3.8 Test Data and Load Estimations

Again in using data supplied by Dr. Rakow, Mr. Railsbeck did not personally examine the laminate of the bucket or he would have recognized that the exemplar bucket used by Mr. Rakow is a different design and all of the testing supplied has absolutely no bearing to the failure of the Keaschall bucket assembly. As clearly evidenced by X-ray imaging on the Keaschall bucket the internal structure of the rib and its load transfer between the vertical mounting ribs and horizontal flange are different than the exemplars provided for his analysis so any finding relating to that data is by definition in error. Having no baseline of the actual strength of the configuration used in the Keaschall bucket he is not able to state that the rated load was exceeded or predict any reasonable failure sequence.

4 Commentary on ESI Report

Commentary and interpretive discussion of key evidence is provided as follows:

4.1 Inspection of Subject Platform

In Photo 10 (page12), the comment that the parallel separation line at location A is caused by shear load is inconsistent with the evidence.

The first principle to be applied for composite laminates is that load orientation and fiber direction must be explicitly related. In the photographs the location and orientation reinforcement direction are not identified. In this case if the shear plane was parallel to the fiber direction the fibers would be in the direction of the load much like 45 degree fiber is used in drive shafts to react to the torque load. This would place the fibers directly in the load path and the failure mode would be fiber breakage.

As taught by Mohr circle of stress transformation any combination of a tensile and shear stress can be represented in a differential element. In the case of composites the weakest failure plane needs to be considered and that is not always aligned with the direction of the applied loads. In this case the picture indicates to me a transverse separation of the fiber bundles due to poor impregnation and compaction of the laminate at the time of manufacture. This would be consistent with the global delamination at the mid-plane of the horizontal flange indicating poor control of the manufacturing process for a RTM laminate as shown in Figure 9.

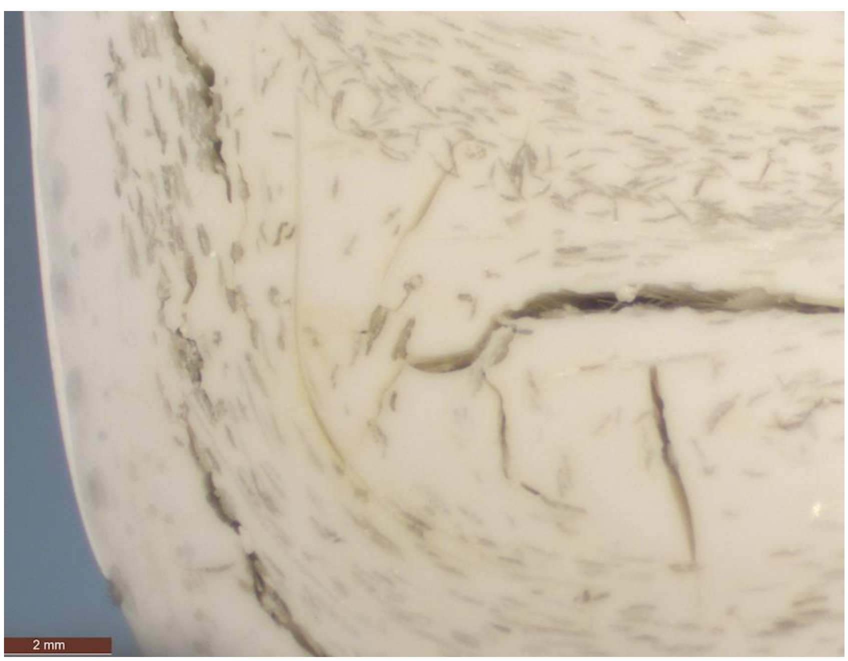

Figure 9 Flange Cross Section View

4.2 Inspection of Exemplar Platforms

Inspection of the x-ray images for the OSB 78768 and OSB 62187 show that they are not the same configuration as the Keaschall bucket. The internal fiber distribution between the vertical rib and horizontal flange have almost nothing in common with the Keashall configuration and are not relevant to understanding the failure mode of the Keaschall accident.

The data will be useful for a follow up industry survey of the existing fleet but cannot be considered relevant to the engineering in this case.

As relating to the Keaschall bucket no data at the time of manufacture have been provided to show that the Altec drawing requirements were properly checked or validated.

4.3 Inspection of Prior Platforms

The testing referenced in TR-0041 performed in 2002 is also not relevant to the Keaschall configuration. As provided in Altec drawing 704-00350 Rev D, by JLL with ECO 03-0855 on 9/16/03 the depth relief cut was increased 0.5 inches removing key reinforcement material from the failure location highlighted in red in Figure 10. The removal of that reinforcement would be key to the actual ultimate failure load of the structure and its continued safe use in service. The release of Rev D effectively created a new and untested configuration of the platform from that point in time moving forward. The Keaschall bucket was fabricated in 2005.

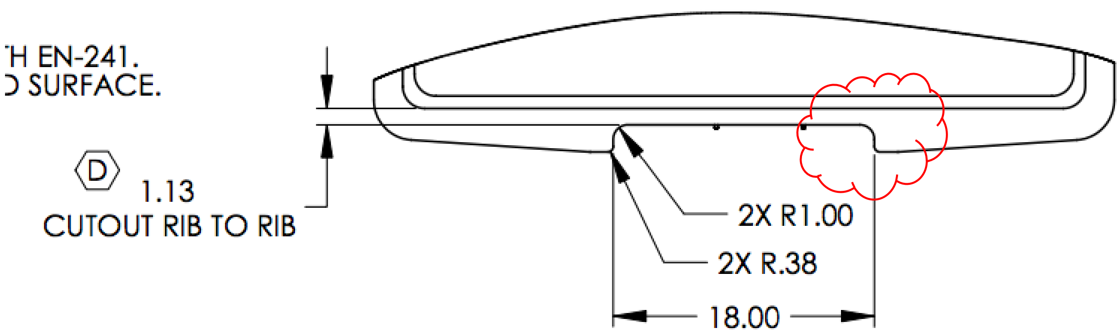

Figure 10 Key Drawing Revision

In addition, during the manufacturing time line, the internal configuration of the lamination was radically changed. This too is completely undocumented with respect to the engineering documents that should be in positive control of the configuration.

It is important to note that Altec has not turned over any document that identifies that the competent design authority did review and authorize the drawing or manufacturing changes or review the changes against structural calculation or product test data. This is not in compliance with the risk management required of an ISO 9000 organization.

4.4 Review of Mr. Shah Reports

The assertion that wide spread delamination in the horizontal flange is not a manufacturing defect but is nothing more than a random discontinuity having no effect on safety is a theory to be considered by a broader panel of experts evaluating the safety of the national vehicle fleet for the configuration of the platform which Mr. Shah tested. For the configuration of the Keaschall platform, it is not valid or reasonable to accept as factual.

In the general case of delaminations, it is usually recognized in the industry that a delamination that is larger than the thickness of the base laminate significantly impacts the design intent of the laminate. The intent of the laminate would have been clearly identified by properly drafted DFMEA and

Mr. Shah makes reference that the damage to the platform should have been sufficient for removal from service. It is important to note that several independent inspection bodies using Altec published documents did not interpret the indications in a similar manner.

The actual true failure load of the Keaschall platform in the virgin, as-manufactured condition is unknown. This means that Altec as the design authority fielded a design for which they did not explicitly know the actual performance data. This is inconsistent with good practice for life critical, man-rated hardware.

4.5 Comments on Micrographs

The SEM micrographs of the laminate are informative in evaluating the resin to fiber interaction within the laminate. In Figure 11 the general condition of the laminate is shown with poor infusion of the resin around the fibers and high void content typical of a manufacturing process not providing the proper consolidation during molding. This is reflected in the macro-scale with the large visible delaminations as shown in Figure 9. This condition is indicative of an underperforming laminate structure with reduced load capacity.

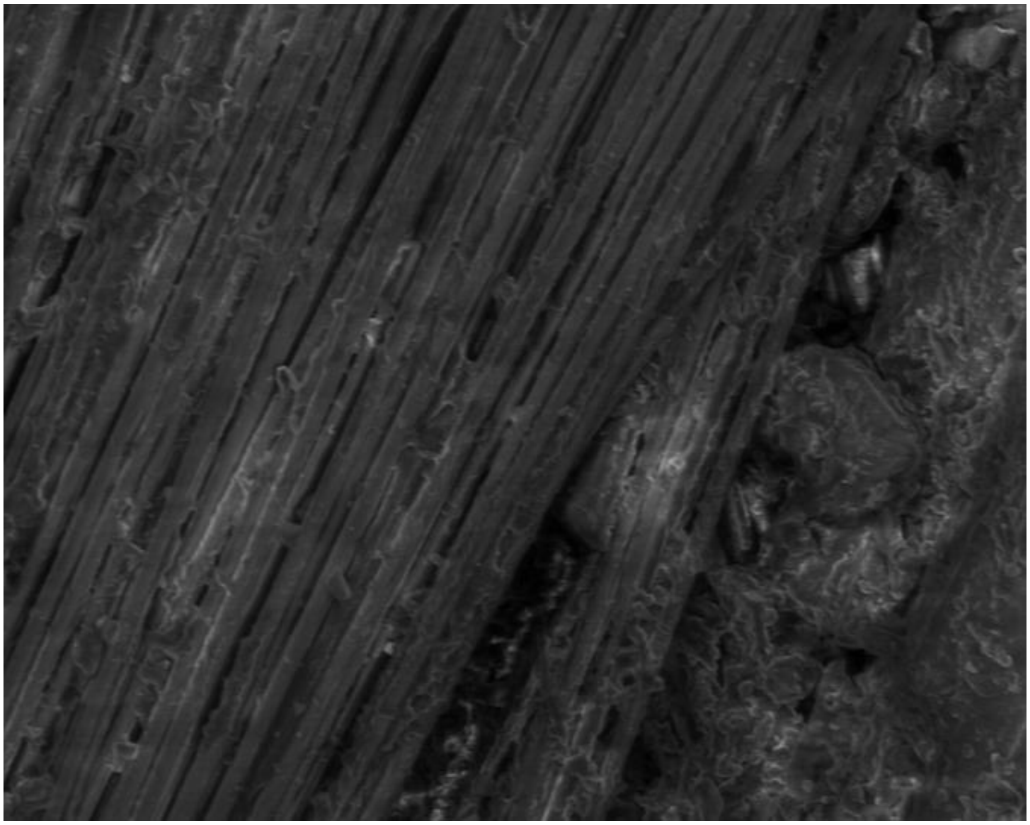

Figure 11 General Matrix Condition

This lack of infiltration of the resin in the fiber layers is also reflected in the poor adhesion of resin to the fibers as in Figure 12 where long lengths of glass fibrils are pulled free of the resin matrix. This is also displayed on the macro scale with the visible fiber pulled free at the failure points.

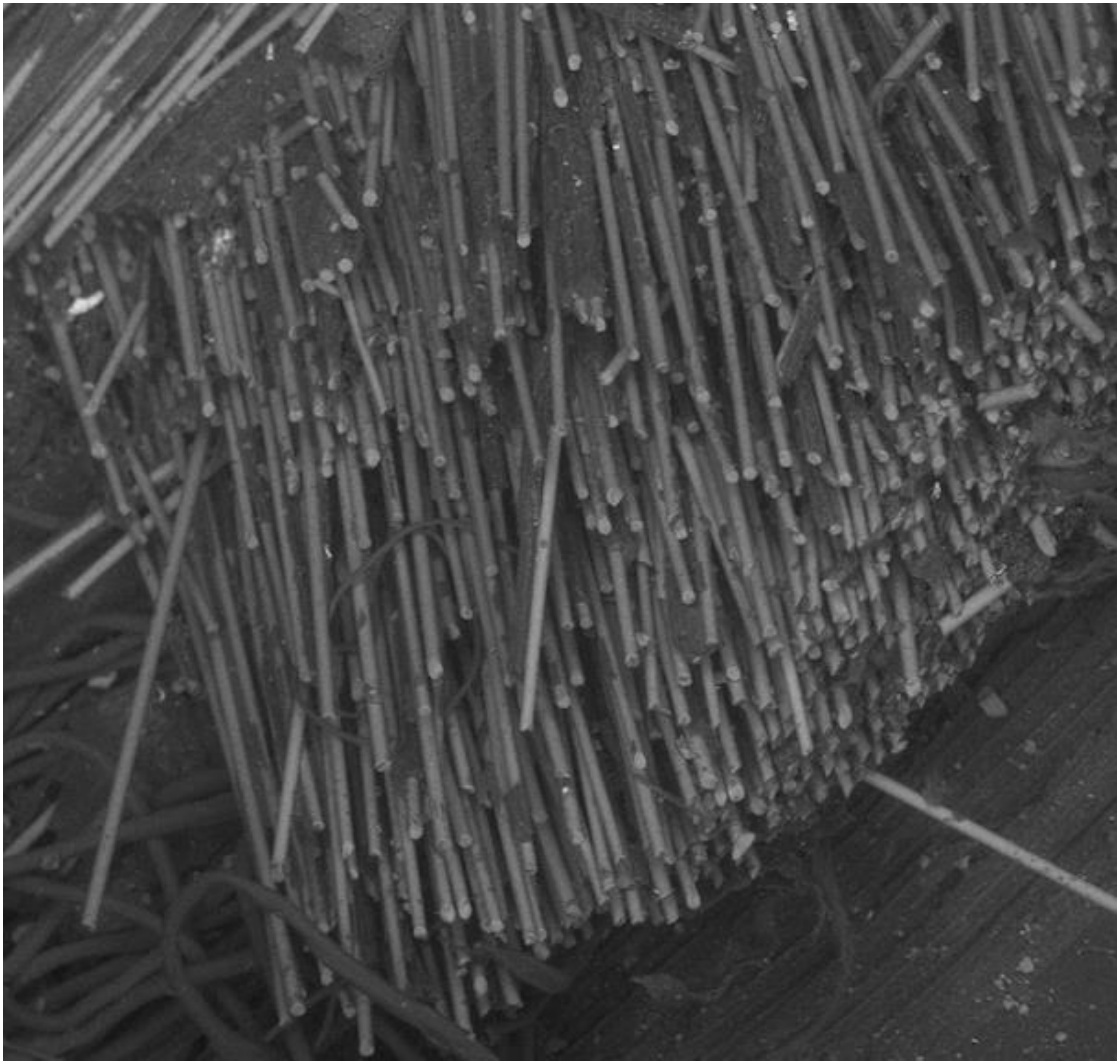

Figure 12 Fibril Extraction

These views can be followed down to the single filament scale in Figure 13 where the lack of resin flow and wetting of the surface is apparent. This probably indicates a fiber surface chemistry (sizing) that is either incompatible with the base resin system or fiber sizing that is past its shelf life. With a manufacturing process that does not track raw material selection or appropriate storage conditions these conditions can manifest itself as under performing laminate in the structure.

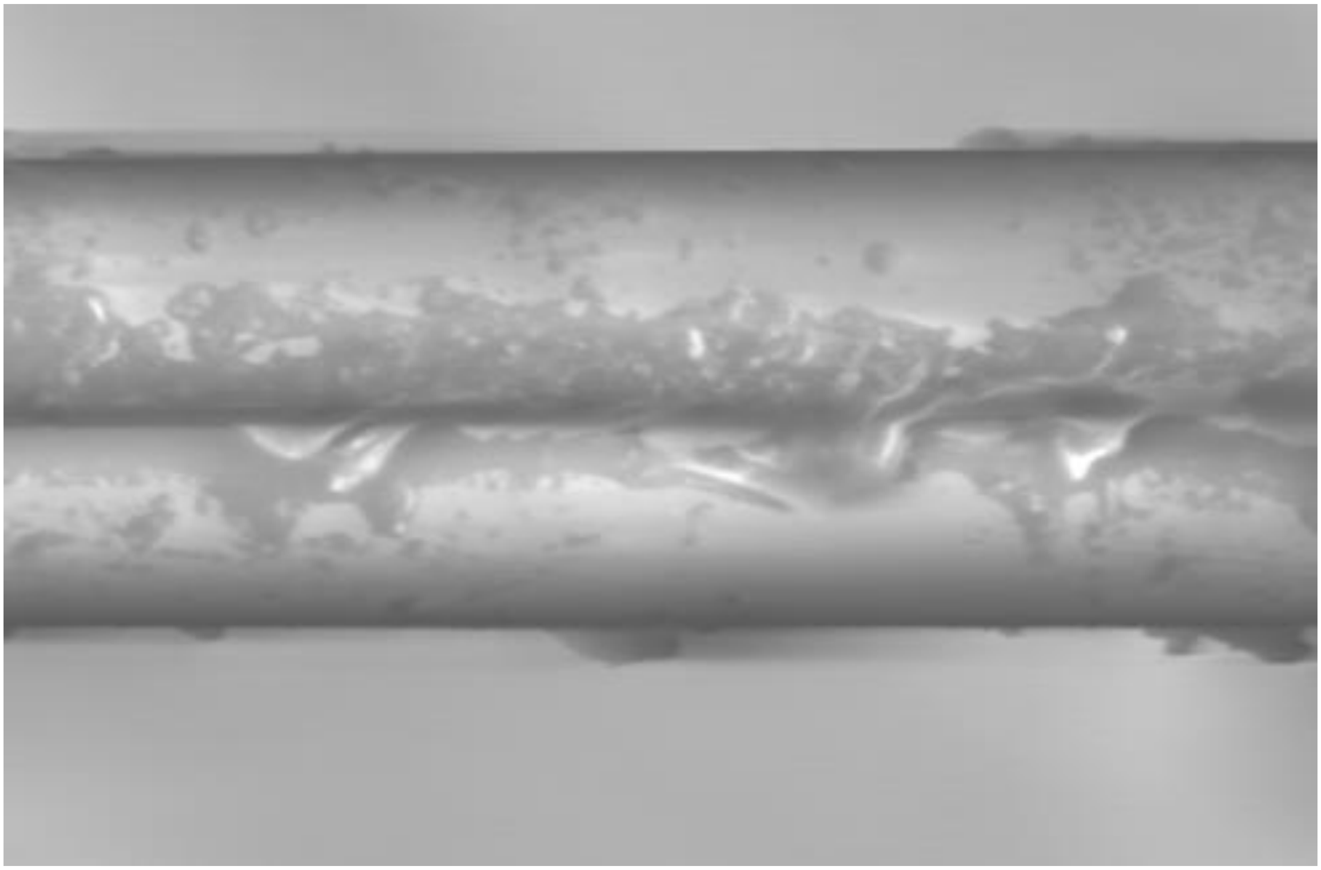

Figure 13 Fibril / Resin Interface

5 Commentary on Exponent Report

Commentary and interpretive discussion of key evidence is provided as follows:

5.1 Altec Industries Aerial Lift Devices

The key point is that the bucket was inspected by competent third party inspectors using the best available published information provided by Altec, and the equipment was within its normal inspection interval.

5.2 Osborne Industries Two-person Platform

The point of clarification is that Figure 4 is not a picture of the Keaschall installation. The figure is for a single person bucket. This distorts the position of Mr. Keaschall in reference to the mounting ribs.

The manufacturing description is generally appropriate for the Keaschall assembly but does not adequately describe the exemplar buckets following in this report or the ones described by Mr. Railsback or Mr. Shah. The internal morphology as provided by x-ray images on prior reports clearly shows a change in the manufacturing technique.

The manufacturing documentation listed is not inclusive to the documentation that is required by a functional ISO 9000 quality control system. There should be extensive documentation of design input, validation, and supplier controls for the 2005 time frame.

The manufacturing build documentation indicated a recordable defect in the Keaschall bucket of folded material in the flange. As part of an ISO 9000 quality control system the competent design authority in charge of the bucket should have recorded concurrence for its use or provided detailed criteria for non-conforming hardware to receiving inspection and acceptance. In this case, consideration should have been given to the folded material's ability to increase the localized fiber volume fraction, which in an RTM part can disrupt resin flow in the mold causing dry spots with low transverse tensile strengths.

A non-inclusive sample list of missing documents

- a.) Material specifications
    - a. Validation of fiber sizing appropriate for the resin
    - b. Appropriate storage methods
    - c. Control of shelf life
- b.) Material test program for as manufactured laminate
    - a. Tensile data
    - b. Aged test data
- c.) Weight controls with error limits, engineering evaluation of go/no go of weights to control resin content and fiber volume factions within accepted industry practice
- d.) Validation of production parameters through the use of PFMEA
- e.) An active Control Plan for all production variables
    - a. Validation of in-process acceptance of manufacturing variances by the competent design authority as noted by the variance accepted by the tracking documentation of the Keaschall bucket
- f.) An active DFMEA listing the critical failure modes and listing the relevant preventions and controls that are used.
- g.) Manufacturing and inspection documents under positive control within the required document management system

The ability to perform post accident calculations is based on disclosure of all manufacturing materials and full disclosure of the manufacturing process. Because of the sparse detail disclosed or recorded the only meaningful source of factual information is carried within the laminate of the failed bucket. The progression of the damage and linkage of the internal defects is clear to an experienced composite engineer through internal shape of the planar delamination and the distribution of internal contamination. Mr. Rakow makes the statement that these defects are common for thick molded sections. I disagree with that assessment in general and specifically for man-rated, life-critical structures. Defects of this nature would be cause for rejection in all military and commercial applications even without the critical man-rated classification. The extensive nature of the defects would be recognized as a production process that lacked sufficient systematic design and manufacturing controls.

The void content of this laminate is well outside standard good practice.

One easily understood cause of rejection would be the internal exposure to external corrosion such as mid acidic water found in acid rain. Acid rain can attack E-glass fibers and cause early stress rupture of loaded fibers. The close out of machined edges and management of contaminant migration is a design consideration to ensure a composite structure meets its intended performance through its rated design life. In addition, it is hard to imagine that a flaw length that approaches the thicknesses of the composite section that it is imbedded in, is not detrimental to the original design intent. In this specific case the delamination reduced the shear transfer internally in the laminate causing a large reduction in the torsional resistance of the cross-section. This along with the effect of concentrating the shearing stress from the molded insert were major factors in the failure.

5.3 Platform Flange and In-service Population

In Mr. Rakow's discussion of the surveyed population of buckets he has failed to show that they represent the Keaschall configuration. The exemplars provided by Mr. Shah, and the bucket inspected by me with a later build date, clearly show a different morphology of internal configuration of the mounting rib. The Keaschall configuration does show a rib insert that was fabricated from a balanced cross ply cloth with visually a high fiber volume fraction. The exemplar buckets show an insert of a different design or likely a configuration where the random cloth mat is tucked and wrapped around the corner of the rib. It is this tuck and wrap around the corner rib and into the bucket shell which is partly responsible for different resolution of internal stresses in the laminate.

Mr. Rakow seeks to understand the performance of the Keaschall bucket in relation to the existing field population. This first step would be to investigate the number of replacement buckets that Altec has supplied to exiting trucks. In my field investigation it was made known to me that a bucket on a different truck was removed from service at the Dawson facility by the Altec personal when they first inspected the Keaschall failure. As told to me the reason was "cracking around the rib mounting holes". If that bucket was similar to the exemplars then the rationale would be easy to explain. As shown in Figure 16 in my report[1] a significant de-bond manifests itself at the mid-plane of the vertical rib.

Given the location of the through mounting holes in the rib, this laminate construction would not be able to support the high compressive load caused by the torque of the bolts. In time the laminate would creep reducing the thickness of the vertical rib. This would cause a loss of pretension in the bolt but it would also cause a circumferential stress at the edge of the bolt hole. Given the light reinforcement of the scrim cloth in that area, the resulting reduction of the rib thickness would cause exceptional high tangential hole strains, which would open cracks radially from the centerline of the hole.

[1] Keaschall Failure Investigation, Appendix A – NDE Review, February 20, 2016

This visual indication would be enough (as already described) to remove a bucket from service. As noted in my discussions the Keaschall configuration does not suffer from this particular design defect. The internal configuration of the rib was able to resist the bolt installation torque and so did not display a visual clue that the bucket was near failure. Another consideration is that the Keaschall bucket is years older than any of the buckets examined and its age-based position in the installed population is unknown. As a fleet leader this accident event is indicating a much larger future problem.

In this case, the Keaschall configuration is unique and not represented by the exemplars provided. The extent of the subject defects within the Altec fleet and its effect on safety or acceptable practice is a topic for a detailed review by risk management experts for the design shown by the exemplars.

5.4 Platform Performance Tests

In these tests the configuration of the exemplars has not been tied to the configuration of the Keaschall configuration and are not suited for projecting the modes of the Keashall failure.

The Finite Element Analysis (FEA) of the bucket is provided by Mr. Rakow with no explanation of the type of elements, material properties, or associated boundary conditions used in the analysis. As shown in the Figure 11 Mr. Rakow makes use of Von Mises stresses which are only suited for isotropic materials. Apportionment of the load equally between the ribs is not a valid assumption as the “rotator” arm which positions the bucket would transfer the load unequally due to its own compliance. A composite FEA model needs to be constructed with 3D layered bricks to maintain accuracy. The use of automatic volume meshing which reduces 3D element volumes to tetrahedral configurations is explicitly invalid as it destroys the element’s ability to correctly resolve the internal shear stresses necessary for anisotropic material input. In addition the element’s material directions must be tracked and recorded in the global reference frame because the global strains must be resolved with the element material directions to accurately calculate the laminate stresses in the direction of interest.

Specifically in this case the internal structure of the vertical rib must be explicitly known so that element stiffness can be queried to resolve the local strain into stresses in the lamina directions. Since the vertical rib is prefabricated with extensive de-bonds between it and the flange, to adequately model the structure, the rib section would have to be installed into the shell membrane with contact elements to correctly capture the resolution of forces and stresses at the point of the mortised connection within the horizontal flange. In addition, contact elements or de-bonds would need to be modeled in the flange geometry.

As provided the FEA model has not been shown to be adequate for composite design, determination of failure modes or representative of the Keaschall configuration.

5.5 Platform Fracture Surface Inspection

Mr. Rakow’s review of the facture surface is inconsistent in that he would have the failure start in the most compliant point of the structure. Given the visually verifiable de-bond and gap between the surface material and the rib structure, and the lack of local material stiffness and thickness, it is not reasonable to believe that this point was more highly loaded than the horizontal flange.

The polishing of cracked surfaces with relative motion cited Mr. Rakow is only appropriate for metallic components and not fiber-reinforced composites. In this case with the large internal defects shown Figure 9 a sizable separation distance between the adjoining layers existed in the laminate at the time of manufacture which prevents recording of fracture extension. Rather in this case with such large internal defects the fracture simply linked the defects in a common delamination plane until the critical condition was reached.

In fact it is clearly stated in Altec publications that the horizontal flange is the primary structural element and that the surface scrim / cloth is used only to provide support for the heavily pigmented surface “gel coat” which is the primary environmental protection for the main structure.

As stated in my previous reports for the Keaschall configuration, the horizontal flange at the mortised joint in Figure 2 (location A) first failed in shear, allowing the flange to rotate off the top of the rib then failing in transverse tension. The resulting loss of stiffness rotated the shell of the bucket body down and outward. The underlying scrim support for the “gel coat” and the nominal bucket shell was insufficient to carry the load so the material separated easily propagating the facture to a location of high geometry stiffness (the curved section at location C). During this time the horizontal flange continued to internally resolve the load as a torsional moment at location B. The load accumulated at location B until it failed by transverse tension normal to the flange thickness from the applied moment. At the time of location B separation, a facture propagated out of location B and headed to meet the point where the fracture from location A entered the curved section of the corner. At this time the bucket resumed its movement rotating around the temporary hinge point at location C. This is evidenced by the rotation of the fracture separation plane normal to the surface of the shell. The shell laminate failed in bending, as the bucket shell continued its rotation down and under the last point of separation.

Mr. Rakow makes note that the mid-plane delaminations were insignificant to the overall structure. But, the evidence in the laminate is that the fracture speed had slowed, and the flange even though crippled was very close to carrying the load of the failure at location A. If the flange was better consolidated, with better through resin impregnation with fewer voids it might have survived the event. Certainly when a structure is designed without redundant load paths it should be fabricated to the highest standards.

From my inspection of the FTIR results of the destructive investigation, the fabricated laminate had a recordable amount of low molecular volatile compounds that might indicate the base resin was solvent reduced. Base resins are normally thinned because they can be ill suited for the RTM process. Solvent reduction was a typical process methodology in 2005 based on the commercial resin selections at the time. Resins solvent thinned and injected require special handling in a closed mold processes to vent volatiles that do not participate in the resin cure and cross linking process. This would include specific venting ports or a mid-process step to burp the mold. If not done properly these solvents will cause voids at the point that it is hardest to escape the laminate. In this case the mid-plane of the flange. Detection of such volatile materials in an aged structure would indicate a high initial concentration in either the base resin or blended in before injection to the mold. The effect of solvent locked into the laminate could interfere with the cure process by separating reactants; leaching of the fiber sizing preventing bonding of the fiber to the resin and numerous other detrimental effects. The yellowing displayed in the failure locations can be likely attributed to aged unreacted base resin. Unreacted resin, by definition does not participate in the structure so the discoloration indicates localized areas of low strength laminate.

KNOTT LABORATORY, LLC
Forensic Engineering & Animation

Engineering Report

Prepared for:

Stephen L. Ahl, Esquire
Wolfe, Snowden, Hurd, Luers & Ahl, LLP
1248 O Street, Ste. 800
Lincoln, NE 68508

Keaschall vs. Osborne Industries

Date of Accident: June 6, 2012

Prepared by:
Ben T. Railsback, M.S., P.E.
Date of Report: June 23, 2016

EXHIBIT
G

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www.knottlab.com

Table of Contents

As you requested, Knott Laboratory, LLC, has investigated an aerial lift bucket separation incident involving an Altec Model AA755L aerial lift truck and a bucket manufactured by Osborne Industries that occurred on June 6, 2012. On the morning of the incident, Dawson Public Power District employee, Mr. Kurtis Keaschall, was using the aerial lift truck while retiring hardware from an electrical pole. As Mr. Keaschall was working within the aerial lift bucket, the bucket separated from the aerial lift boom, and subsequently both the bucket and Mr. Keaschall fell to the ground. As a result of the incident, Mr. Keaschall sustained fatal injuries.

1.0 <u>Purpose:</u>

The purpose of this investigation was to reconstruct the incident, determine the probable cause of the incident, and to respond to conclusions offered by Mr. John Eihusen on September 26, 2015.

2.0 <u>Procedure:</u>

Knott Laboratory reviewed the provided materials listed in Appendix A; reviewed additional materials obtained by Knott Laboratory listed in Appendix B; inspected the bucket and dielectric bucket liner on July 13, 2015; visited Osborne Industries manufacturing facility on August 10, 2015 to view the manufacturing process; performed photogrammetry of scene photographs to establish locations of evidence; conducted a kinematic analysis of the bucket falling; analyzed wind data and determined the drag effects of wind on the bucket falling; studied the kinematics of the boom hydraulic system; tested failure mode hypotheses; simulated the kinematics of the bucket falling; and finally established contributing factors and the probable cause of the incident.

3.0 <u>Background</u>

Mr. Kurtis Keaschall, a lineman employed by Dawson Public Power District ("Dawson"), was contacted by a landowner who requested the removal of an electrical line from the landowner's property a day before the incident (June 5, 2012).[1] On the morning of the incident, Mr. Keaschall took the Dawson aerial lift truck #3505 to the landowner's property near Ravenna, Nebraska to start removing the line.

At around 10:30 am on the morning of the incident, Mr. Jerry Hobelman, a consumer accounts manager for Dawson arrived at the site to create a staking sheet for the job. Upon arrival, Mr. Hobelman saw Mr. Keaschall in the bucket removing hardware from the pole. Mr. Hobelman was working inside his truck near a meter pole 140 feet from where Mr. Keaschall was working. Mr. Hobelman looked up from his computer and noticed the hydraulic wrench hanging from the lift truck's boom.

[1] Deposition transcript of Mr. Jerry Hobelman taken on September 9, 2015, p. 23.

Mr. Hobelman drove towards the accident scene and noticed Mr. Keaschall lying face down and unconscious. Mr. Hobelman also observed the detached bucket on the ground.

Mr. Hobelman described in his accident report that Mr. Keaschall "was breathing, but there was blood coming from his nose and possibly his mouth." Mr. Keaschall was also observed wearing a safety harness, however, the was no lanyard connecting the safety harness to the boom arm lanyard anchor.

Mr. Hobelman went back to his truck and issued a mayday call over the radio around 11:15 am to the Kearney outpost of Dawson Public Power. After issuing the mayday call, Mr. Hobelman checked on Mr. Keaschall, who had started to regain consciousness, but was unable to speak.

The ambulance arrived and transported Mr. Keaschall to Good Samaritan hospital. Police investigators photographed the incident scene. Dawson employees, Carl Kyle, Trent Trampe, Dean Kunkee, and Jeremy Kaiser arrived at the scene while the police were still there. Mr. Kunkee and Mr. Trampe took scene measurements, and Mr. Kaiser drew a scene diagram.

Additional photographs were taken by Dawson employees at the scene. According to Mr. Kaiser, the bucket and tools had not been moved prior to photographing the scene.

None of the Dawson employees involved in the investigation were able to reconstruct the incident based on the evidence, nor were any of the employees able to offer any personal opinion as to why the bucket separation occurred.

Three days after the incident (June 8, 2012), Mr. Mike Moore P.E., Altec's Manager of Product Engineering, traveled to the Dawson garage in Lexington, NE to inspect the Altec truck and the separated bucket.

Mr. Moore concluded after his inspection, "The ultimate failure of the platform involved in the accident is consistent with an external force applied to the platform."

4.0 Accident Scene Evidence

Knott Laboratory relied on scene photographs, Mr. Moore's June 8, 2012 inspection photographs of the bucket, Altec truck, and utility pole, Knott Laboratory's inspection photographs of the bucket, and high definition 3-D laser scans of the bucket to analyze the physical evidence associated with the bucket, the aerial lift truck, the utility pole, and debris scattered near the pole.

Knott Laboratory applied photogrammetry, the process of positioning objects shown in photographs in virtual space, to the photographs taken by police and by Dawson employees using photogrammetry software PhotoModeler. A 3-dimensional scaled

diagram was created showing the positions of the aerial lift truck, boom, and the bucket at the accident scene (Figure 1).

From the 3-dimensional scaled model, Knott Laboratory was able to determine the orientation of the boom at the accident scene.

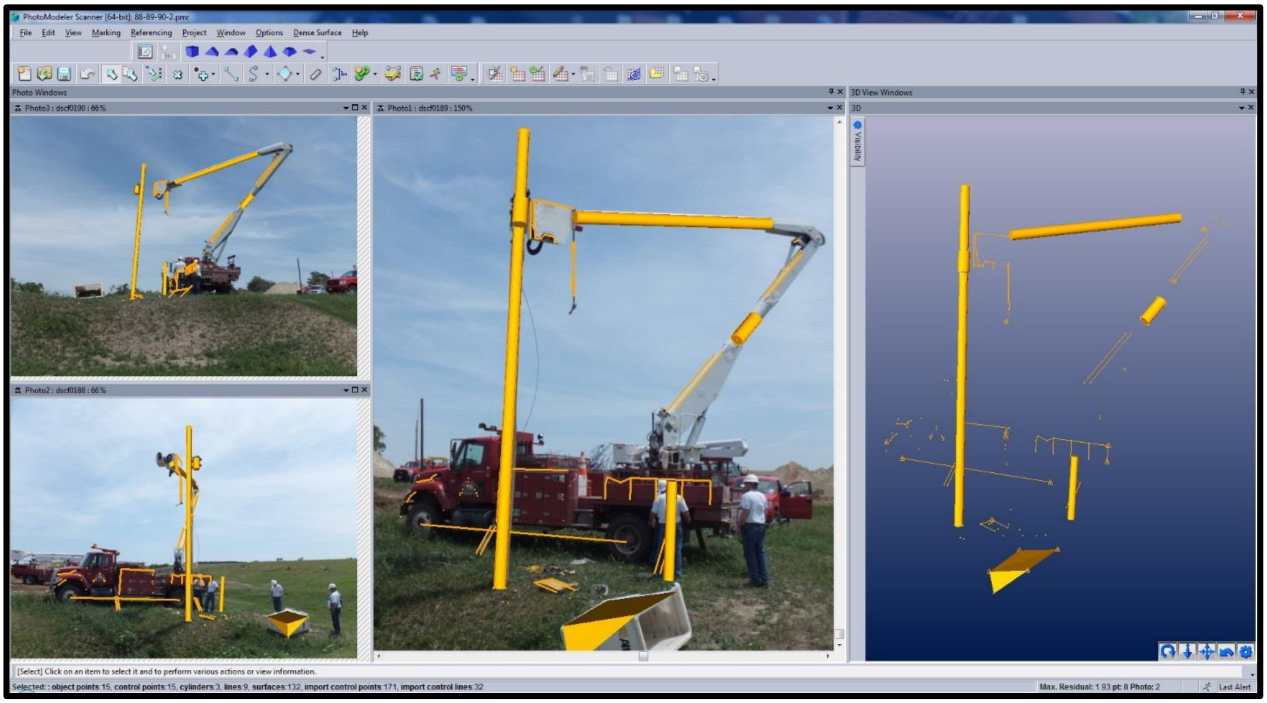

Figure 1: Photogrammetry of accident scene conducted by Knott Laboratory.

The accident occurred at the approximate coordinates 41 degrees, 5 minutes, 7 seconds North and 99 degrees, 0 minutes, 42 seconds West in central Nebraska. The location and the pole and location and orientation of the Altec truck are shown in Figure 2. The Altec truck was oriented north, and the pole was located to the west of the truck.

Figure 2: Aerial photograph of accident scene. Altec truck in yellow box, base of pole shown by yellow arrow. Graphic by Knott Laboratory.

4.1 <u>Aerial lift truck and bucket evidence</u>

The Altec truck was built on a 2005 International 7300 chassis with a vehicle identification number of 1HTWAAAR55J172992. According to the Altec specifications, the truck has a wheelbase of 205 inches.

Knott Laboratory reviewed photographs to determine physical damage to the truck consistent with the incident. A large bend was observed in the Altec truck's left rear railing (Figure 3). Based on photogrammetry analysis, the depth of the railing bend is approximately 4 inches. A significant external force was required to plastically, or permanently, deform the railing.

White paint transfer consistent with the color of the fiberglass bucket was observed below the bottom railing (Figure 3). Corresponding red paint transfer consistent with the color of the Altec truck's body color was observed on the left front bottom corner[2] of the fiberglass bucket (Figure 4). The presence of corresponding paint transfer between the fiberglass bucket and the Altec truck's railing is consistent with the left front bottom corner of the bucket contacting and bending the railing of the Altec truck.

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[2] Through the report the north edge of the bucket (when attached to the boom) will be referenced as the front of the bucket. Similarly, the south edge will be referenced as the rear, the west edge as left, and the east edge as right.

Figure 3: Bend on left rear railing on Altec truck.
Photograph taken by Dawson employee at accident scene.

Figure 4: Red paint transfer on the bottom front left corner of the fiberglass bucket. Photograph taken by Dawson employee at accident scene.

Knott Laboratory analyzed whether or not the bucket could have bent the railing while still attached to the boom (Figure 5). As shown in Figure 5, the boom cannot be oriented in such a manner that the bottom left corner of the fiberglass bucket contacts the railing while the bucket is still attached to the boom. Therefore, the bucket impacted the railing after it had separated from the boom.

Figure 5: Graphic showing the bucket could not have bent the railing while still attached to boom. Graphic by Knott Laboratory.

Knott Laboratory reviewed the provided photographs of the bucket and inspected the bucket on July 13, 2015. Several sharp chops and relatively wide indentations were observed along the left upper rim of both the bucket and the bucket liner (Figure 6). The chops and indentations on the bucket and bucket liner are consistent with repeated external forces applied downwards on the bucket and bucket liner.

Figure 6: Photograph of the bucket and bucket liner with several indentations. Photograph taken by Mr. Mike Moore, P.E. on June 8, 2012.

Further, the wrench socket shown in Figure 7 and Figure 8 appears to be bent downwards, which is consistent with significant external bending loads applied to the socket in excess of normal handheld operation. Therefore, both the bucket, bucket liner, and hydraulic wrench socket experienced significant external loading.

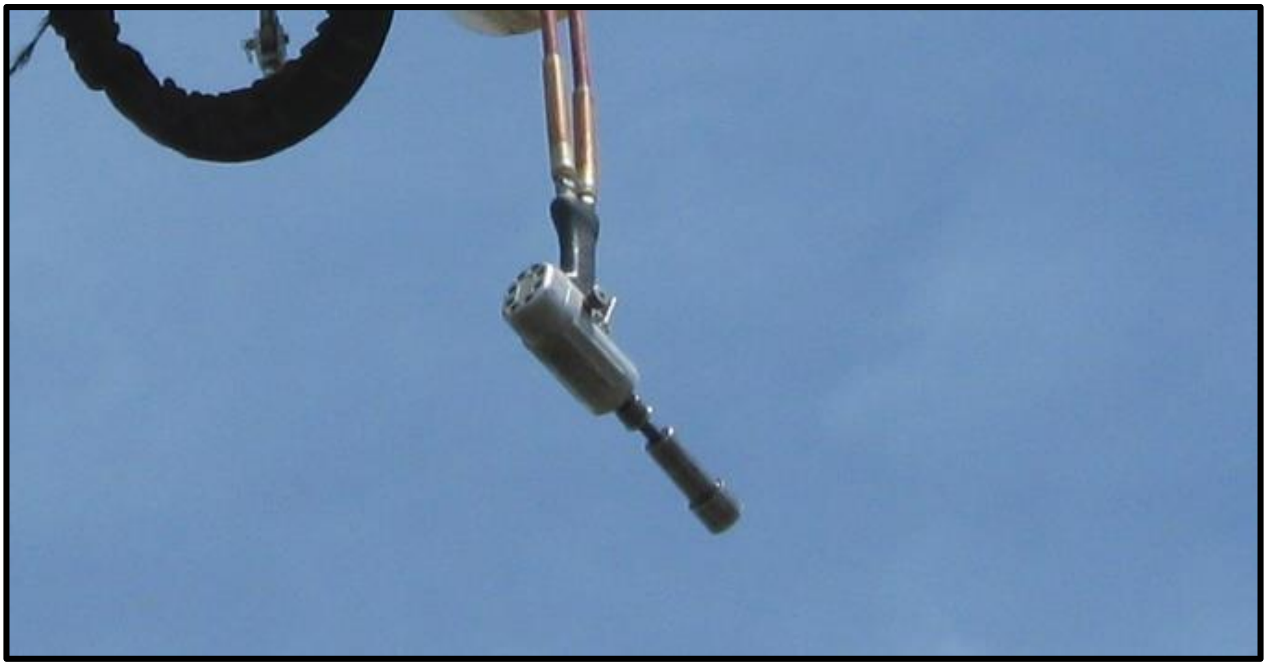

Figure 7: Bent hydraulic wrench socket consistent with external loading applied to the socket. Accident scene photograph.

Figure 8: Bent hydraulic wrench socket consistent with external loading applied to the socket. Accident scene photograph.

4.2 Utility pole evidence

The photogrammetry analysis was used to determine the dimensions of the pole above ground (Figure 9). The pole's height was 341.3 inches. The base diameter of the pole was approximately 8.9 inches and tapered down to a diameter of approximately 6.7 inches at the top of the pole.

The lower half of the pole leans to 55 degrees east of north (Figure 10). The direction of the lean is consistent with the direction of the electrical cables to the northeast.

Knott Laboratory reviewed scene photographs taken by police and Dawson employees to analyze the pole's hardware. The guy-wires had been cut, the electric cables were removed from the pole, and several hardware components were removed prior to the incident.

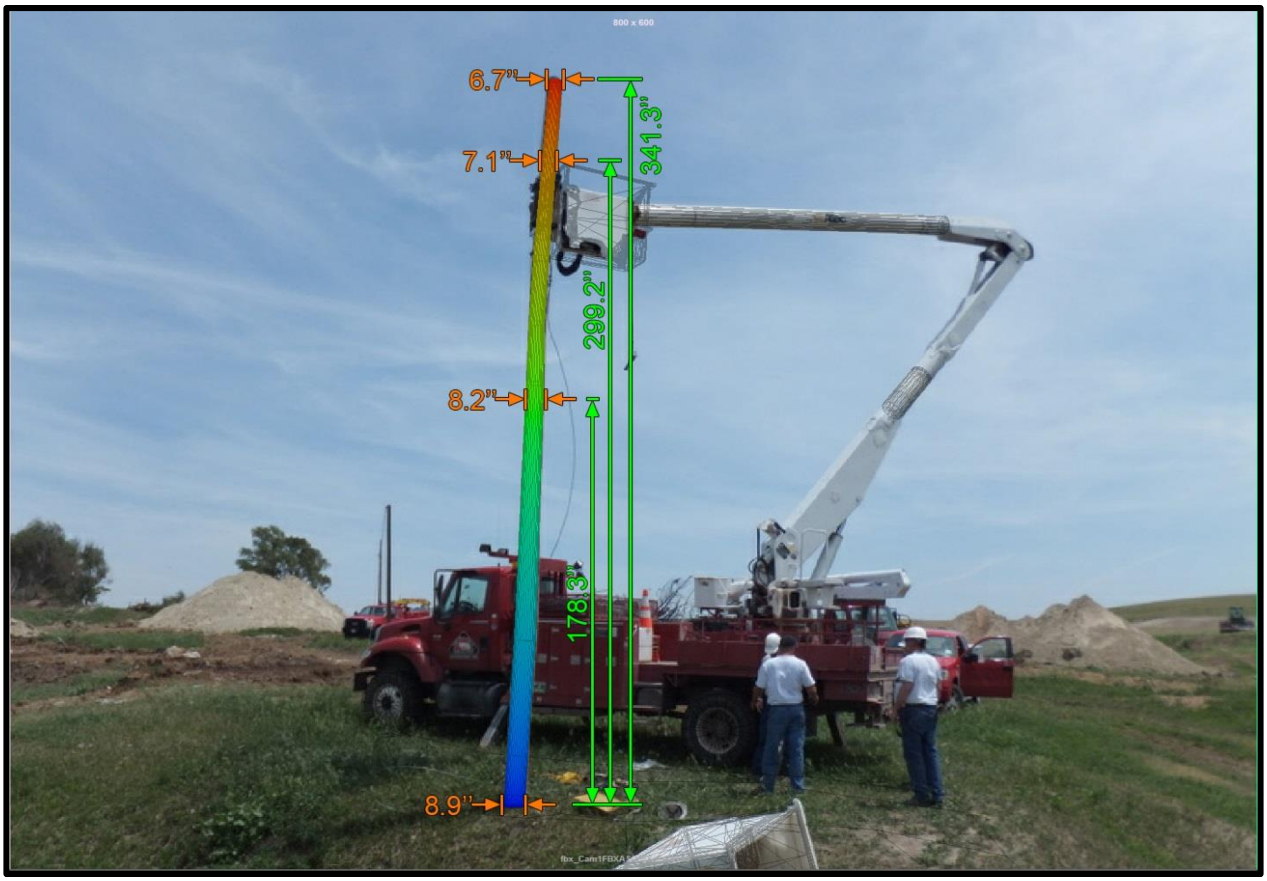

Figure 9: Dimensions of the utility pole from Knott Laboratory photogrammetry.

Figure 10: Angle of pole leaning. Graphic by Knott Laboratory.

Further, a photograph taken by a Dawson employee shows a loose spring washer on the lower transformer bolt, which is consistent with a loosened nut on the lower transformer bolt (Figure 11). The loosened transformer nut is evidence that Mr. Keaschall had been working on the nut prior to the bucket separation incident.

An accident scene photograph shows white paint marks under both the upper and lower transformer bolts perpendicular to the pole (Figure 12). The white paint marks are consistent with the white color of the bucket. Therefore, it is possible the white paint marks were deposited by the bucket pressed against the pole

Figure 11: Partially unfastened nut on lower transformer bolt.
Photograph taken by Dawson employee.

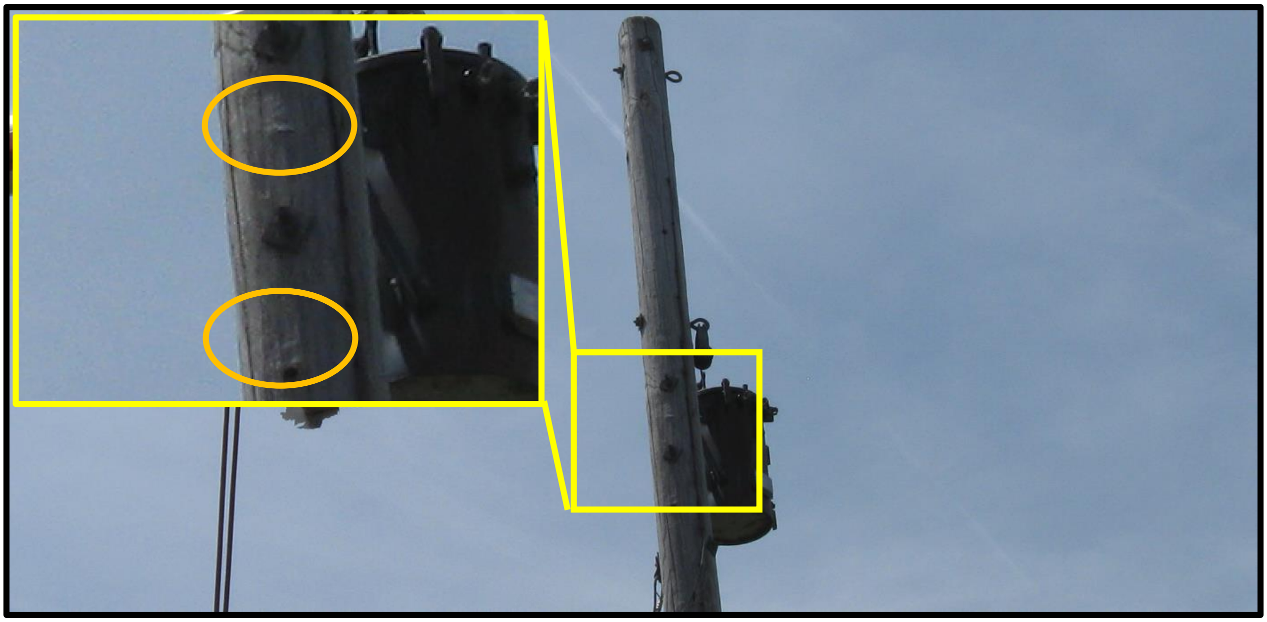

Figure 12: Perpendicular white marks below both upper and lower transformer bolts consistent with white color of the bucket. Accident scene photograph.

4.3 <u>Ground debris</u>

After the bucket separated from the boom, struck the Altec truck railing, Mr. Keaschall was deposited between the base of the pole and left side of the truck as evidenced by the fall-protection harness removed from his body. (Figure 13)

The bucket also had a tool board that had separated from the left edge of the bucket after the bucket fell that came to rest west of the truck. The bucket itself also came to rest to the west of the truck (Figure 14 and Figure 15).

Figure 13: Area Mr. Keaschall was deposited. Accident scene photograph.

Figure 14: Area Mr. Keaschall was deposited, tool board, and bucket. Accident scene photograph.

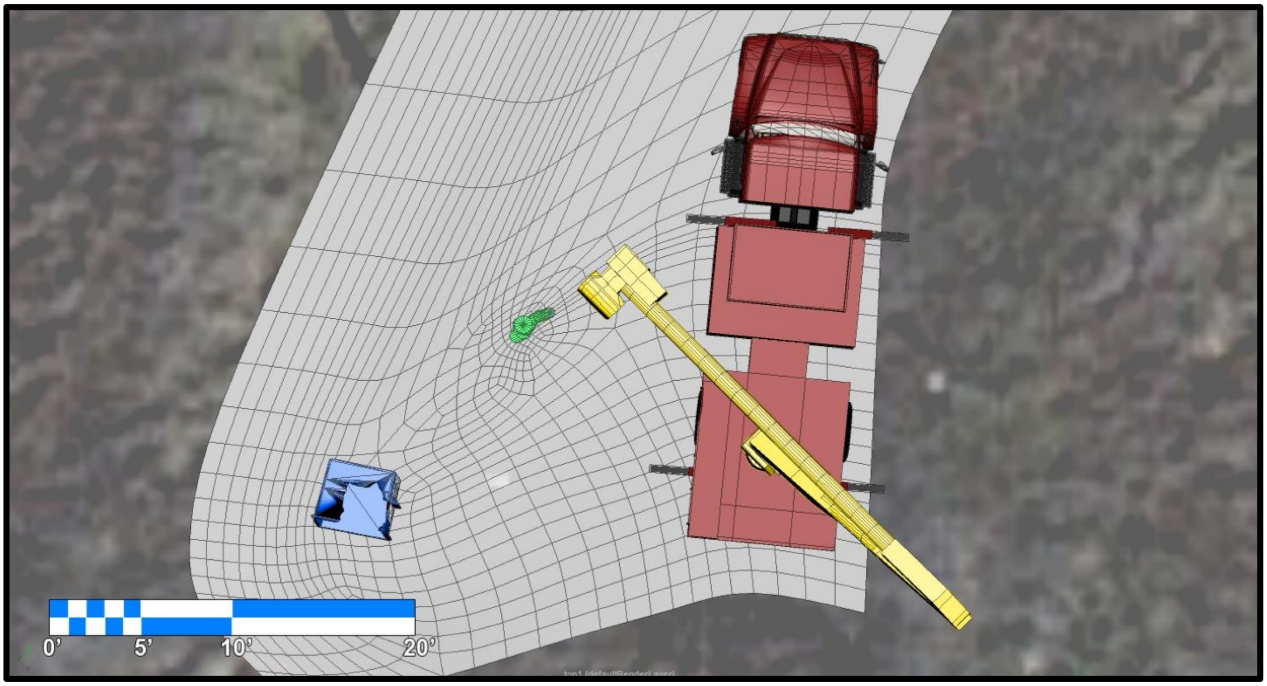

Figure 15: Scaled diagram showing rest position bucket. Graphic by Knott Laboratory.

5.0 <u>General bucket kinematics (motion) of separation</u>

After identifying the locations of key physical evidence through photogrammetry, Knott Laboratory analyzed the general kinematics or motion of the bucket as it separated from the boom, and determined whether the general kinematics outlined in Mr. Eihusen's engineering report was physically possible using engineering simulation software, PC-Crash 10.0.

First, Knott Laboratory aligned the virtual model of the bucket into the virtual photogrammetry scene with the broken rib section of the bucket still attached to the boom representing where the bucket would have been had it still been attached to the boom at the accident scene. The location of the red contact mark on the bucket was determined to be 9 feet 2 inches horizontally to the southeast from the corresponding contact dent on the Altec truck's railing (Figure 16). Therefore, the bucket had to travel rearwards after separation from the boom.

In order for the bucket to travel rearwards 9 feet 2 inches towards the Altec truck railing, the bucket would have required an initial velocity towards the rear at separation.

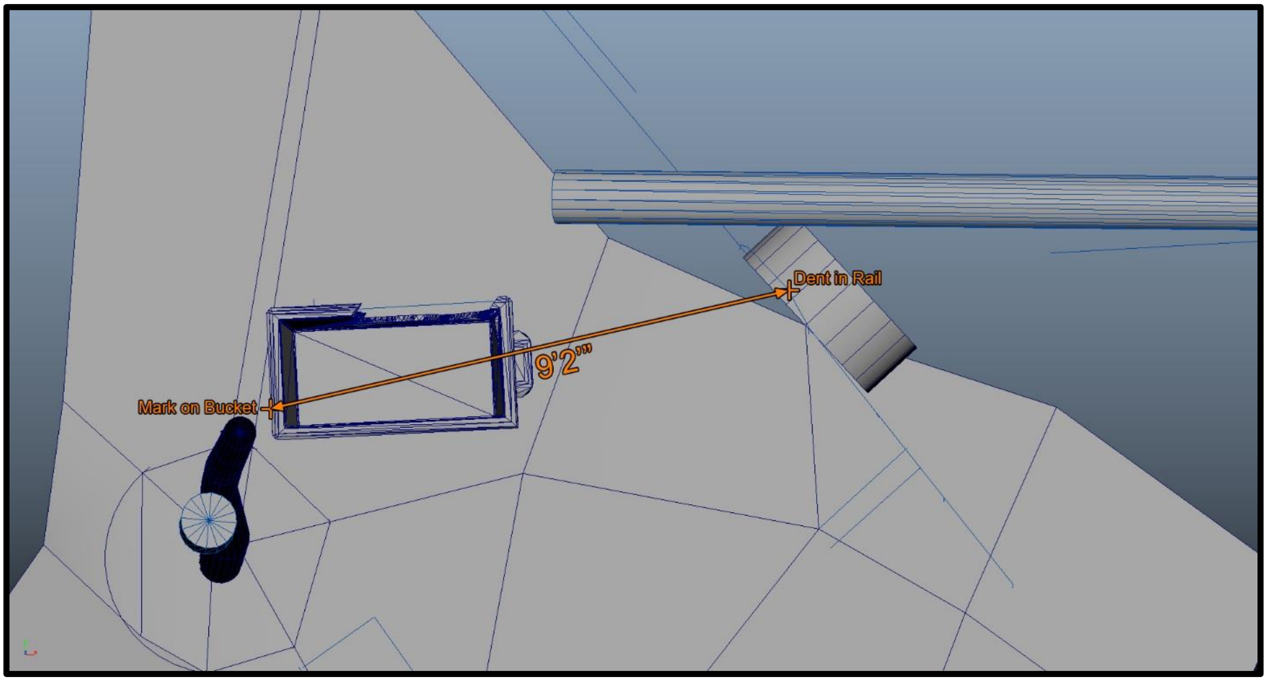

Figure 16: Horizontal distance from bucket contact mark to dent in rail based on Knott Laboratory's photogrammetry.

5.1 Mr. Eihusen's failure mode and bucket kinematics:

Mr. John Eihusen, P.E. offered an explanation of the failure mechanism and rearward movement of the bucket towards the dent in the railing after separation,

> *"At time of failure the compromised composite resolving Mr. Keaschall's body weight into vertical rib failed in shear at or near the vertical rib insert which triggered the catastrophic failure of the bucket."*

Therefore, Mr. Eihusen apparently concluded that the primary external loading on the bucket at the time of failure was Mr. Keaschall's body weight. Mr. Eihusen also described how Mr. Keaschall's body weight, alone, contributed to the rearward motion of the bucket after separation:

> *"In effect Mr. Keaschall was dumped head first out of the bucket. The mechanics of the separation would have also imparted an angular momentum on the bucket as it fell free from the boom. This would have caused it to travel backward under the boom into the truck box resulting in the bent frame railing."*

While Knott Laboratory agrees that the mechanics of the separation would have imparted an angular momentum on the bucket as it fell free from the boom, Knott Laboratory does

not agree that Mr. Keaschall's body weight alone would have resulted in any significant rearward, translational, movement of the bucket after separation from the boom.

Knott Laboratory conducted simulations showing the separation of the bucket as explained by Mr. Eihusen.[3] The hypothetical simulation shows that as the bucket separation occurred, the bucket began rotating, consistent with Mr. Eihusen's statement.

However, contrary to Mr. Eihusen's statement, the simulation shows negligible translational rearwards movement of the bucket after separation towards the dent on the railing (Figure 17 and Figure 18).

Figure 17: Visualization of the simulated drop position of the bucket after separation and free-fall from boom as opined by Mr. Eihusen. Graphic by Knott Laboratory.

[3] Simulation assumed Mr. Keaschall initially near the left side of the bucket with the bucket failing near the right rear corner of the bucket. This assumption imparts maximum rotational motion.

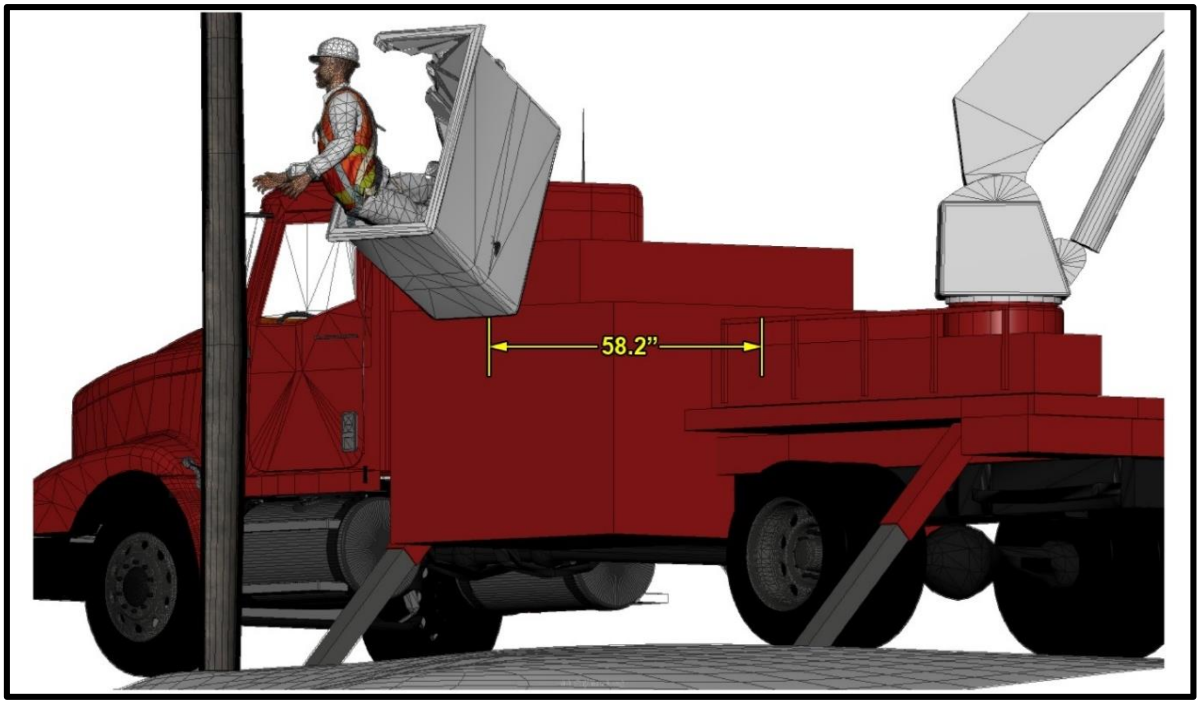

Figure 18: Distance of bucket from dent in railing during simulation of Mr. Eihusen's failure scenario. Graphic by Knott Laboratory.

Therefore, Mr. Eihusen's conclusion that Mr. Keaschall's weight alone imparted enough rearwards momentum to cause the left front bottom corner of the bucket to strike the railing is not consistent with physics based on analysis of the event.

6.0 <u>Reconstruction of events</u>

Knott Laboratory investigated three external force application scenarios to determine whether or not the scenarios were consistent with both the physical evidence and with the bucket kinematic and dynamics.

6.1 <u>Wind effects</u>

The only external environmental force that could have acted on the bucket <u>after</u> the bucket separated from the boom was wind.

Knott Laboratory obtained the weather history for Kearney Regional Airport, approximately 25 miles south of the incident site. The reported weather at 10:55 am, near the time of the incident, was clear skies, temperature of 75.2 degrees Fahrenheit, and wind speeds of 13.8 mph directed to the south to southeast. The maximum reported wind gust speed on the day of the incident was 23 mph.

The approximate wind speed and direction at the time of the incident relative to the bucket and truck are depicted in Figure 19.

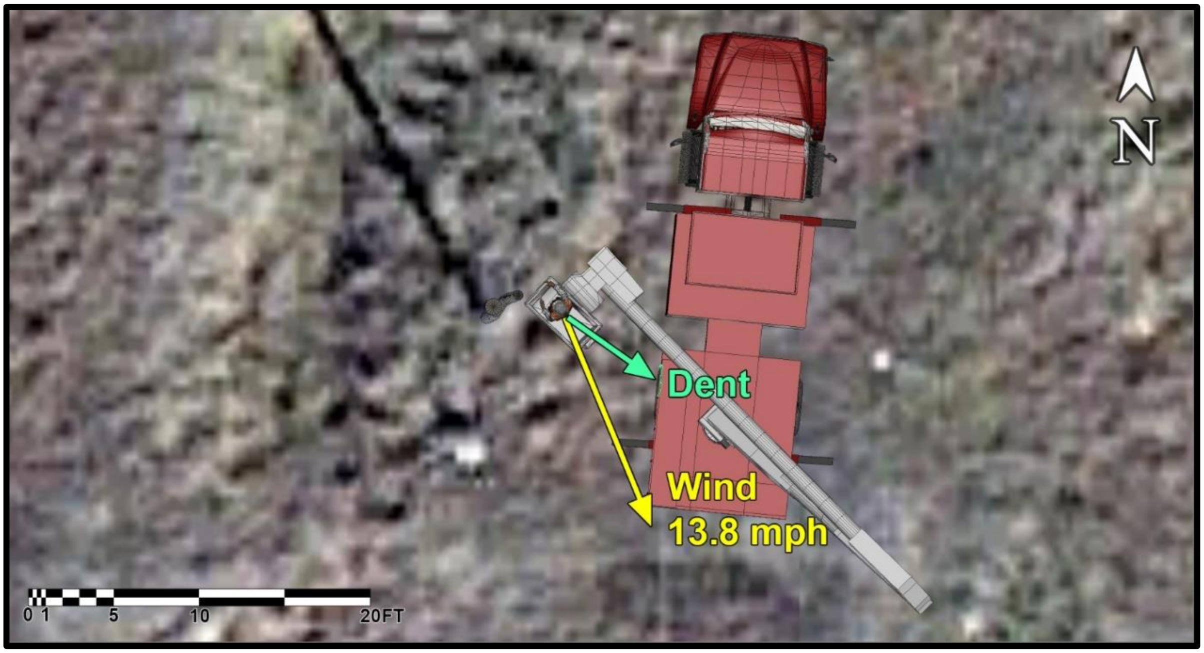

Figure 19: Wind speed and direction relative to truck at time of incident. Graphic created by Knott Laboratory.

Under the maximum possible wind force, the bucket would have only traveled to the south southeast approximately 2 feet, significantly shorter than the distance of 9 feet 2 inches traveled by the bucket after separation. Therefore, an additional external force was needed beyond wind.

Knott Laboratory analyzed two additional external rearward forces acting on the bucket prior to separation. The first scenario involves the bucket pushed frontwards against the pole, and the second scenario involves the bucket pushed upwards against the pole hardware, specifically the upper or lower transformer bolt. Both scenarios were compared with the physical evidence to determine which, if either, physically resulted in the required rearward force needed for the bucket to contact the railing and matched with the physical evidence.

6.2 <u>Bucket pushed against pole</u>

The first additional hypothetical external force examined involved the bucket pressed frontwards horizontally against the pole creating an equal and opposite rearward force in the direction the bucket traveled. In this scenario, the bottom boom was raised such that the left front corner of the bucket made contact with and pressed against the utility pole.

The amount of force required to cause the bucket to separate from the boom would have bent the pole at least 10 inches away from the truck. (Figure 20).

Figure 20: Bucket pushed into the pole deflecting pole a minimum of 10 inches. Knott Laboratory still frame from visualization.

As a result of exceeding the materials strength of the bucket, the bucket would have separated and traveled rearwards towards the railing of the truck, which is consistent with the post-separation movement of the bucket. However, in this hypothetical scenario, the tip of the boom would have come to rest at least frontwards of where the boom tip came to rest during the incident. (Figure 21). Therefore, the hypothetical scenario of the bucket pushing frontwards into the pole creating a large equal and opposite external force is not consistent with the physical evidence.

Figure 21: Hypothetical boom tip (left) comes to rest forwards of the actual rest position (right). Still frame from Knott Laboratory visualization and accident scene photograph.

6.3 <u>Bucket contact with transformer bolt</u>

The second scenario involved interaction between the bucket and the pole hardware, specifically the upper or lower bolts used to secure the transformer (see Figure 11), to create the required rearward external force.

In this scenario, the left-side of the bucket is laterally pressed up against the pole and upwards against the upper transformer bolt, as evidenced by the white paint deposits shown in Figure 12.

Mr. Keaschall raises both the upper and lower booms thus resulting in loading on the bucket liner (Figure 22). As the booms are raised, the booms begin to deflect, creating hazardous stored energy, while the bucket remains fixed against the bolt. As the stored energy increases, more force is transferred to the ribs of the bucket securing the bucket to the boom arm.

Figure 22: Initial force acting downwards on the bucket from transformer bolt. Graphic by Knott Laboratory.

Eventually, the force exceeds the strength of the bucket ribs securing the bucket to the boom arm, and the bucket begins to separate from the boom. As the bucket beings to separate, the force on the bucket begins to change from purely downward loading to both downward and rearward loading (Figure 23), which is consistent with the bucket traveling rearwards towards the dent in the railing.

Figure 23: Bucket caught on upper transformer bolt. Still frame from Knott Laboratory visualization.

After the bucket separates, the boom arm springs upward, rearward, and laterally to the right to its final rest position consistent with the rest position of the boom arm depicted in accident scene photographs.

The scenario of the bucket pressed against the transformer bolt is consistent with the physical evidence and provides the external rearward force needed for the bucket to hit the railing. Therefore, the bucket was pressed against the transformer bolt during the incident.

6.4 <u>Bucket forces and testing</u>

After determining the bucket was pressed against a transformer bolt, Knott Laboratory analyzed the forces acting on the bucket during the incident. Knott Laboratory first simulated the separation motion of the bucket and Mr. Keaschall using PC-Crash 10.0 in order to determine the speed and direction the bucket separated from the boom arm.

Using Altec failure test data and bucket separation velocity determined through simulations, Knott Laboratory was able to determine that a peak external force of approximately 1,600 pounds was applied to the bucket by the transformer bolt. For comparison, the rated load capacity of the bucket is only 700 pounds. Therefore, Mr.

Keaschall had exceeded the rated load capacity of the bucket by pushing the bucket up against the transformer bolt.

Additionally, Dr. Joseph Rakow conducted a test using an exemplar bucket and completely removed material from the flange and rib of the bucket to simulate the delamination reportedly observed on the subject bucket. During the test, Dr. Rakow applied a vertical load of 700 pounds to the approximate position of the bucket that would have come into contact with the transformer bolt. Bucket separation and/or failure did not occur during the test, nor were there any reported cracking or tearing sounds coming from the bucket. Therefore, Knott Laboratory's analysis showing Mr. Keaschall exceeded the vertical load capacity is consistent with Dr. Rakow's testing.

7.0 <u>Contributing factors</u>

Knott Laboratory reviewed the AA755L Operator's Manual and OSHA regulations to determine contributing factors to the incident.

7.1 <u>Altec AA755L Operators Manual</u>

Within section 5, "Operation" on page 26 of the operator's manual, it is stated

> ***"Warning Death or serious injury can result from improper use of the boom(s) or platform(s). Do not use the boom(s) or platform(s) surfaces to push or support objects such as poles, conductors, etc."***

Also within section 5, "Operation" on page 26 it is stated:

> ***"Warning Death or serious injury can result from overloading the unit. Do not exceed the capacity values."***

Mr. Keaschall failed to follow the aforementioned warnings by pushing the bucket into the pole and against the transformer bolt and then overloading the bucket beyond capacity. Failure to follow the warnings directly resulted in the bucket separating from the boom and Mr. Keaschall's subsequent fatal injuries. Had Mr. Keaschall followed the warnings and not externally loaded the bucket beyond capacity, the accident would have been prevented.

Within section 4, "Before You Operate…" on page 19 it is stated,

> ***"Danger The lanyard connected between the OSHA approved fall protection system and the boom tip lanyard anchor must always be used and kept in good condition. It should never be replaced with a lanyard of different length. It should never be replaced with any material that is conductive."***

Mr. Keaschall failed to follow the operator's manual by not properly attaching a lanyard between his safety harness and the boom tip lanyard anchor. The failure resulted in Mr. Keaschall falling 22 feet after the bucket separated from the boom.

7.2 OSHA regulations

The Occupational Safety and Health Administration (OSHA) specifies safety and health regulations for usage of aerial lift platforms such as the Altec boom lift under standard number 1926.453, titled, "Aerial lifts."

OSHA regulations require operators working from boom lift platforms to wear a body belt with a lanyard attached to the boom under 1926.453(b)(2):

> *"A body belt shall be worn and a lanyard attached to the boom or basket when working from an aerial lift."*

Mr. Keaschall was not wearing a lanyard attached to the boom at the time of the incident and therefore failed to comply with OSHA regulation 1926.453(b)(2) and the operator's manual. Mr. Keaschall's failure to comply with OSHA 1926.453(b)(2) and the operator's manual directly resulted in him falling approximately 22 feet after the bucket separated from the boom.

OSHA regulations also require operators work from boom lift platforms to not exceed manufacturer specified load limits under OSHA 1926.453(b)(2)(vi)"

> *"Boom and basket load limits specified by the manufacturer shall not be exceeded."*

The rated load limit for the platform was 700 pounds, significantly less than the approximately 1,600 pounds[4] of external force applied to the platform. Therefore Mr. *Keaschall* failed to comply with OSHA regulation 1926.453(b)(2)(vi) and the operator's manual. Mr. Keaschall's failure to comply with OSHA 1926.453(b)(2)(vi) and the operator's manual directly resulted in the bucket separating from the boom. Had Mr. Keaschall complied with OSHA 1926.453(b)(2)(vi) and the operator's manual, the accident would have been prevented.

7.3 ANSI A92.2-2001 standard

The American National Standard Institute (ANSI) has developed a standard for "Vehicle-Mounted Elevated and Rotating Aerial Devices", such as the boom lift.

[4] The calculated external force applied to the platform does not include additional weight of the operator and materials.

Section 10 of the ANSI A92.2-2001 standard outlines the "Responsibilities of Operators." Section 10.2, titled "Operation", states:

> *"During operation of the aerial device all occupants shall use appropriate fall protection connected to the aerial devise at the platform position."*

Mr. Keaschall was not wearing a lanyard attached to the boom at the time of the incident and therefore failed to comply with the ANSI A92.2 standard, OSHA 1926.453(b)(2) and the operator's manual. His failure to comply with the ANSI standard, OSHA regulations, and operator's manual directly resulted in him falling approximately 22 feet after the bucket separated from the boom. Had Mr. Keaschall complied with the ANSI standard, OSHA regulations, and operator's manual, he would not have fallen 22 feet after the bucket separated from the boom.

Section 10.5 of the ANSI standard titled, "Loading" states:

> *"Any loading which includes a horizontal load shall be avoided unless the mobile unit is designed for that application."*

The bucket was not designed to be loaded beyond its rated capacity. Therefore Mr. Keaschall failed to comply with ANSI A92.2, OSHA regulation 1926.453(b)(2)(vi) and the operator's manual. Mr. Keaschall's failure to comply with ANSI standard, OSHA regulations and the operator's manual directly resulted in the bucket overloading and separating from the boom. Had Mr. Keaschall complied with the ANSI standard, OSHA regulations and the operator's manual, the bucket would not have separated, and the accident would have been prevented.

8.0 <u>Conclusions</u>

Based on available evidence, scientific research literature, published test data, and the engineers' training, education, and experience, the following conclusions were reached:

1. Mr. Keaschall applied external loading to the bucket, which exceeded the rated load capacity of the bucket.

2. Mr. Keaschall's failure to follow the warnings stated in the operator's manual, OSHA regulations, and ANSI standard regarding external loading of the bucket and attaching a lanyard to the boom, directly resulted in the bucket separating from the boom and directly resulted in Mr. Keaschall falling 22 feet to the ground. The failure to follow the operator manual warnings, OSHA regulations, and ANSI standard is the probable cause of the accident.

3. Had Mr. Keaschall complied with OSHA regulations, ANSI standards and the operator's manual, the accident would have been prevented.

4. Mr. Eihusen's conclusion that Mr. Keaschall's weight alone imparted enough rearwards momentum to cause the left front bottom corner of the bucket to strike the railing is not consistent with physics based on analysis of the event.

The opinions and conclusions expressed in this report are based on the information available to the engineer as of the date of this report. As discovery continues, additional information may become available that will affect his opinions and conclusions.

Respectfully,

KNOTT LABORATORY, LLC

COLORADO LICENSED
BENJAMIN TURNER RAILSBACK
BTR
40307
PROFESSIONAL ENGINEER

Ben T. Railsback, M.S., P.E.
Director of Mechanical Engineering

Appendix A: Additional Provided Materials Reviewed By Knott Laboratory

1. Declaration Page General Liability Policy
2. AEM Aerial Devices Safety Manual
3. Altec Self Directed Sentry Operator Safety Training Workbook
4. Build Records
5. Conrad Email
6. Complaint and Demand for Jury Trial
7. Amended Progression Order
8. Affidavit of Joseph Rakow
9. Altec Drawing Platform, Mold, Ribbed
10. Altec Drawing Platform, Fiberglass, Rectangular
11. Fiberglass Platform Construction – Procedure No. EN-241-P
12. Maintenance and Parts Manual
13. Moore Memo – Summary Report of Inspection
14. Operator's Manual
15. PUN 2010A, Secondary Lanyard Attachment
16. Service Records
17. Universal Inspections 2-16-11
18. DPPD Photos
19. Dawson Photos
20. Altec Bucket Photos SN OSB39386
21. Altec Bucket Photos SN OSB62811
22. Sherman County Sheriff Department Photos
23. Deposition of Jeremy Kaiser
24. Deposition of Jerry Hobelman
25. Deposition of Dean Kunkee
26. Binder 1
27. Exhibits 21-44
28. Exhibits 100-112
29. NES Platform Photos
30. Somat Data
31. Test A
32. Test A2
33. Test A3
34. Test B
35. Test C
36. Test F
37. Test G
38. Test H
39. NES Meeting Notes
40. 121602 MC Kent
41. Tr00141 Test Report
42. Tr00141 Test Summary

43. Unit Platform Cross Reference
44. TR00741 Photos and Video
45. Platform Hole Locations
46. TR00471 Summary
47. TR00741 Test Log Platform Performance
48. TR00741 Test Report
49. TR00822 Photos
50. Platform Performance Test Log
51. Testing Matrix
52. TR00822 Test Summary
53. TR00822 Test Report
54. TR00835 Pictures
55. Reference Items
56. Template Test Report
57. Template Test Summary
58. TR00835 Test Log
59. TR00848 Photos
60. Program & PCL
61. Quality Inspection Report
62. TR00848 Procedure and Test Log
63. TR00848 Summary
64. TR00848 Summary Test
65. TR00848 Test Log and Procedure
66. TR00848 Test Plan
67. TR00848 Test Report
68. TR00848 Test Report 2
69. Westar Platform
70. TR01075 Data
71. TR01075 Fixture Setup
72. TR01075 Pictures and Video
73. Accelerometer Map For Collecting Roading Data
74. Accelerometer Map For Collecting Roading Data PowerPoint
75. Test Log Uplander Platform Roading
76. TR001075 Test Plan
77. TR01075 Road Data Correlation end hung
78. TR01075 Road Data Correlation
79. TR01075 Roading Accelerometer Parameters
80. TR01075 Summary
81. TR01075 Test Report
82. Uplander Parts Decal
83. Uplander Test Decal
84. Analytical & Materials Engineering, Inc. Report dated 10/30/15
85. EiCon Services Summary Findings dated 10/26/15

Appendix B: Additional Material Obtained and Reviewed By Knott Laboratory

1. Weather Underground historical data for Kearney, NE regional airport.
2. Google Earth imagery of accident site.
3. OSHA regulations.
4. Drag properties of various shapes.
5. ANSI/SIA A92.2-2001 "Vehicle-Mounted Elevating and Rotating Aerial Devices."
6. (839) Eight hundred thirty nine photographs taken of bucket and bucket liner taken 07/13/15
7. (14) High definition laser scans of the bucket
8. (348) Three hundred forty eight photographs of Osborne Industries manufacturing facility taken 08/10/15
9. Human Factors Design Handbook Second Edition by W. Woodson, B. Tillman, and P. Tillman
10. Materials Science and Engineering An Introduction Seventh Edition by W.D. Callister, Jr.
11. Introduction to Fluid Mechanics Sixth Edition by R. Fox, A. McDonald, and P. Pritchard.
12. Gates VIN Decoder
13. Diesel Truck Index
14. Mechanical Properties of Wood by D. Green, J. Winnandy, and D. Kretschmann.

Failure Analysis Associates

Exponent®

Keaschall v. Osborne Industries, et al.

Expert Report

Joseph F. Rakow, PhD, PE

EXHIBIT

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Exponent
Failure Analysis Associates

Keaschall v. Osborne Industries, et al.

Expert Report

Prepared for

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Wolfe, Snowden, Hurd, Luers & Ahl, LLP
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1248 O Street, Suite 800
Lincoln, NE 68508

Prepared by

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June 2016

Doc. no. 1502730.000 - 7382

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Limitations

Exponent investigated specific issues relevant to the subject incident, as requested by Wolfe, Snowden, Hurd, Luers & Ahl, LLP. The scope of services performed during this investigation may not adequately address the needs of other users of this report, and any reuse of this report or its findings, conclusions, or recommendations is at the sole risk of the user. The opinions and comments formulated during this investigation are based on observations and information available at the time of the investigation.

The findings presented herein are made to a reasonable degree of engineering certainty. We have endeavored to be accurate and complete in our assignment. If new data become available or there are perceived omissions or misstatements in this report, we ask that they be brought to our attention as soon as possible so we have the opportunity to address them.

Personal Background

I am a Principal Engineer in Exponent's Mechanical Engineering practice. I have expertise in the areas of mechanical, structural, and aerospace engineering, with particular expertise in composite materials. I am routinely hired by clients to analyze failures in composite components, and to assist in composite product development and stewardship. These matters have involved composite aircraft and spacecraft, as well as aerial lift devices, automobiles, sporting equipment, pipelines, medical devices, and building products, among other products. On a number of occasions, I have been invited by professional organizations to speak and train their membership on composite materials and composite failure analysis.

I hold a Ph.D. and an M.S. in aerospace engineering from the University of Michigan, as well as a B.S. in physics from the University of California, Davis. I am a licensed professional mechanical engineer in the state of California. Prior to joining Exponent, I held teaching and research positions at the University of Michigan and Sandia National Laboratories.

I have published a number of scientific articles and frequently present at national and international technical conferences. I am a contributing author to the International Civil Aviation Organization (ICAO) *Manual of Aircraft Accident and Incident Investigation*, having authored the chapter addressing failure analysis of composite structures. In addition, I am a Visiting Lecturer in the Aeronautics and Astronautics Department at Stanford University, and I teach an introductory composites course to professional engineers and the Department of Defense through the American Society of Materials.

Opinions

Based on review of information and documentation provided to me and listed in this report, my inspection of the available physical evidence, and my analysis, I have formed the following opinions in this matter:

1. The subject platform did not fail due to a manufacturing or design defect.
    a. No evidence of a manufacturing or design defect has been identified in the subject platform. Plaintiff's expert claims a pre-existing delamination caused the subject failure, but similar delaminations appear to be present throughout the population of nearly 12,000 platforms of this model, and reportedly none of those platforms have failed.
    b. The subject platform model can withstand loads well beyond its rated capacity even in the presence of significantly more extensive damage than the delamination identified by plaintiff's expert.
2. The subject platform failed likely due to misuse involving loading conditions above its rated capacity. The fracture surfaces are rough and fibrous, consistent with overload failure.

Basis for Opinions

On June 6, 2012, around 11:00 am, Kurt Keaschall, lineman for Dawson Public Power, was working in an aerial lift near Ravenna, Nebraska. He was working to remove a transformer when the lift platform (i.e., bucket) fractured and detached from the boom. The majority of the platform and its liner fell to the ground, while the back wall of the platform remained attached to the boom. Figure 1 shows the scene after the incident occurred. Figure 2 and Figure 3 show the portions of the platform on the ground and on the boom, respectively.

Exponent was retained to provide engineering analysis related to this incident. Our activities have included a review of available documents, examination of physical evidence, and engineering analysis.

Figure 1. Post-incident scene.

Figure 2. Subject platform with liner after incident.

Figure 3. Subject platform portion attached to the boom after the incident.

Altec Industries Aerial Lift Device

The subject aerial lift consists of a truck, an articulated boom, and a two-person platform attached to the end of the boom. The subject Altec unit was model AA755L, serial number 040BZ3559, and was delivered to Dawson Public Power on April 2005, where it was designated as truck 3505.

According to Dawson Power employees, the linemen are required to visually inspect the various components of the unit, including the platform, before use and to report any concerns to the mechanics.[1] Third-party inspections are performed twice per year. During these inspections, dielectric is measured and the linemen look for cracks and other signs of damage. The last third-party inspection prior to the subject incident was performed in February 2012, approximately four months before the subject incident.[2] The platform reportedly passed the inspection with no reported issues at that time.

Osborne Industries Two-person Platform

The subject platform (serial number OSB39386) was manufactured by Osborne Industries (Osborne, KS) in March 2005, approximately seven years before the subject incident. Referred to as model 704-00541, the platform is designed to hold two individuals and has a rated capacity of 700 pounds. The platform is made of fiberglass, which in this case is vinylester resin reinforced with glass fiber. Figure 4 shows a schematic of the -541 model platform and the various components, such as the ribs, flange, and step. The platform is attached to the boom via a set of fasteners in each rib.

Osborne manufactures the platform by resin transfer molding (RTM), a common manufacturing technique used for many composite products and applications. RTM consists of a male and female mold pair in which dry glass fiber preforms and fabric are placed, the mold is closed, and then resin is injected into the closed mold. For the subject platform model, the ribs, which are also fiberglass, are precured prior to being inserted into the mold. The ribs are attached to the main platform body and flange by overwrapped fiberglass fabric, and are then cured altogether to consolidate into one structure.

Exponent visited Osborne's manufacturing facility and observed the platform production process. Osborne's manufacturing process includes a number of quality control processes:

- Raw materials quality control, such as testing resin on receipt and checking certificates of compliance for glass products.
- Weighing glass fiber preforms prior to placing them in the mold.
- Utilizing glass product kits.
- Tracking resin injection and molding parameters.

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1 Deposition of Jeremy Kaiser.

2 Deposition of Dean Kunkee.

- Visually inspecting the platform throughout the manufacturing process, such as after removing it from the mold, after machining operations, and prior to packaging for shipment.
- Measuring barcol hardness on the bottom of the platform.
- Weighing the platform.
- Testing the mechanical strength of the lanyard anchor and the platform step
- Documenting quality parameters throughout the production process for each individual platform, from raw materials preparation to shipping. A document entitled *Aerial Platform Inspection Report* accompanies each platform throughout the manufacturing process.

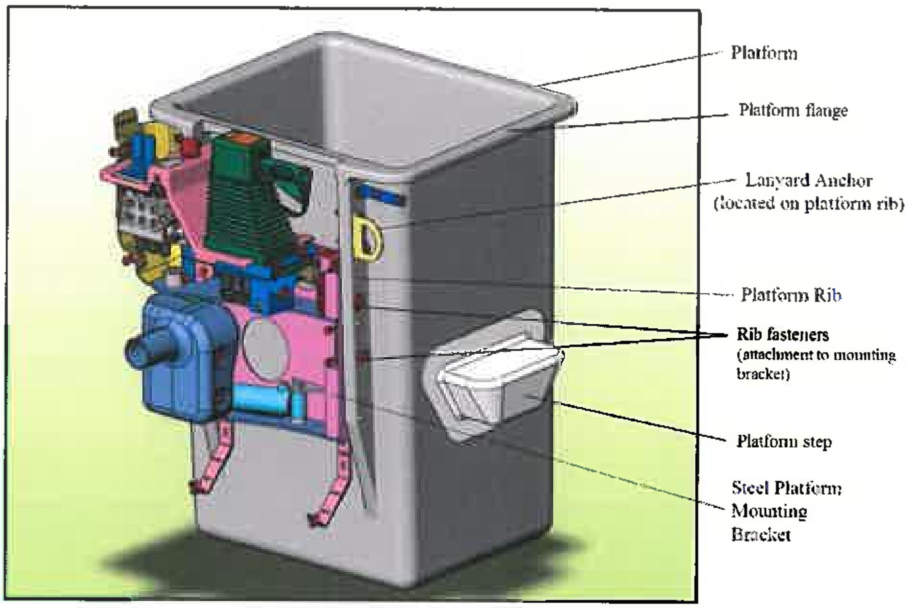

Figure 4. Schematic of the -541 platform.[3]

Opinion of Plaintiff's Expert John Eihusen

Exponent has reviewed reports written by plaintiff's expert, John Eihusen. Mr. Eihusen opines that since the time it was manufactured, the subject platform flange contained a delamination (unlaminated area) in location A.[4] Location A is marked in Figure 5 and is described by Mr. Eihusen as being near or adjacent to the top of the preformed vertical rib on the right-hand side of the platform. Mr. Eihusen hypothesizes that the delamination grew in service and caused

[3] PUN 2010A, Secondary Lanyard Attachment (00081563xA37B1).PDF, Altec 749-50080, July 23, 2010, p. 2.

[4] Although Mr. Eihusen refers to this feature as a delamination, we refer to it as an unlaminated area because the area was not laminated at the completion of manufacturing. Delamination implies an area was laminated during manufacturing and then became delaminated at a later time.

the platform to fail. Interestingly and unfortunately, Mr. Eihusen performs no calculations and conducts no tests to support his opinion.

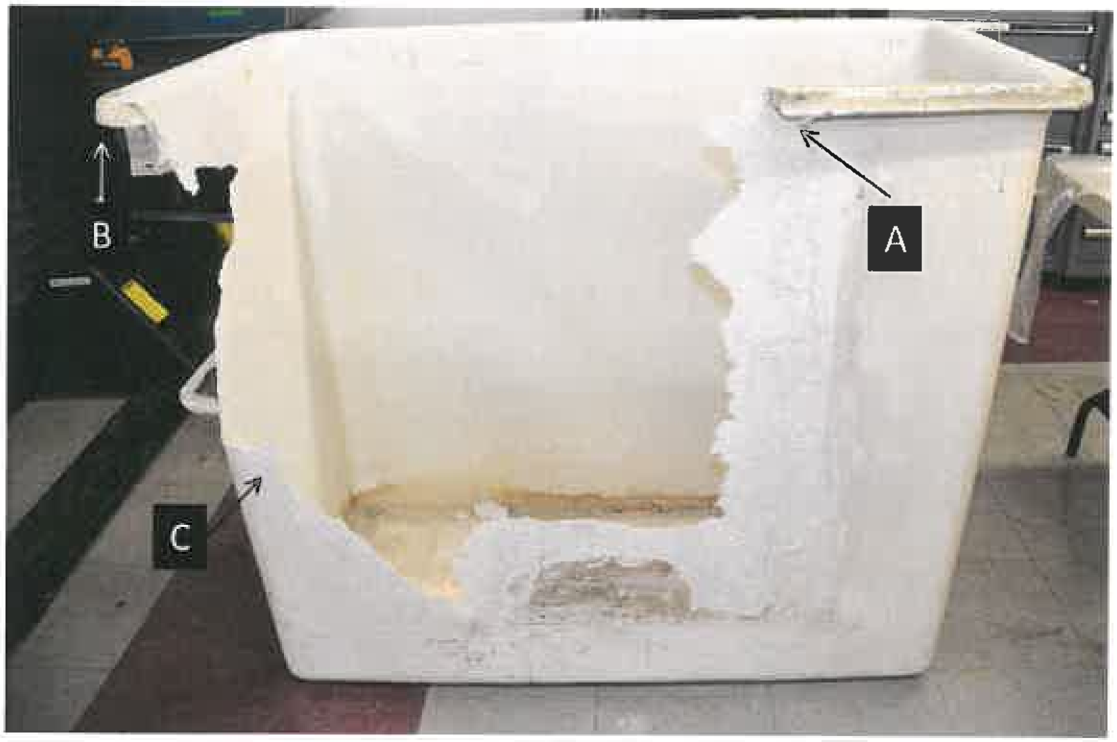

Figure 5. Portion of failed subject platform with locations identified.

-541 Platform Flange and In-service Population

Mr. Eihusen's root cause conclusion is flawed because he fails to realize that unlaminated areas are common in the -541 platform flange. Exponent has examined the flanges of nine platforms to date, and all nine platforms contain unlaminated areas in the flange, adjacent to the ribs. These platforms include the subject platform (OSB39386), seven exemplar platforms provided to Exponent by Osborne (OSB883782, OSBXXXXX, OSB8385X,[5] OSB82845, OSB82685, OSB84104, OSB84510), and a ninth platform that Mr. Eihusen pulled out of service (OSB62811). Mr. Eihusen analyzed the ninth platform with x-ray and confirmed the presence of unlaminated areas. Unlaminated areas in all seven exemplar platforms are shown in Figure 6 and Figure 7.

It is not surprising to find unlaminated areas in these flanges, given the thickness of that portion of the platform. Thick molded composite parts are susceptible to entrapped air and potentially unlaminated locations.

[5] Complete serial number not available on two samples.

The unanimous result of nine-for-nine flanges containing unlaminated areas near the ribs indicates that these features are commonly present throughout the population of -541 platforms. Osborne has manufactured and sold nearly 12,000 platforms of the -541 model between 1999 and July of 2015, and the subject incident is the only in-service catastrophic failure that has ever been reported to Osborne. Moreover, Osborne has sold nearly 28,000 two-person platforms and more than 64,000 total platforms during this time period, all of which have thick flanges molded by Osborne's RTM process, yet the subject incident is the only in-service catastrophic failure that has ever been reported to Osborne.

With the common presence of unlaminated areas and the lack of catastrophic failures, Mr. Eihusen's conclusion that the subject platform failed due to an unlaminated area is in contrast to the demonstrated performance of this product in service, including its unlaminated areas. In other words, Mr. Eihusen has failed to identify the factor in this incident that caused the subject platform to fail while others in service have not.

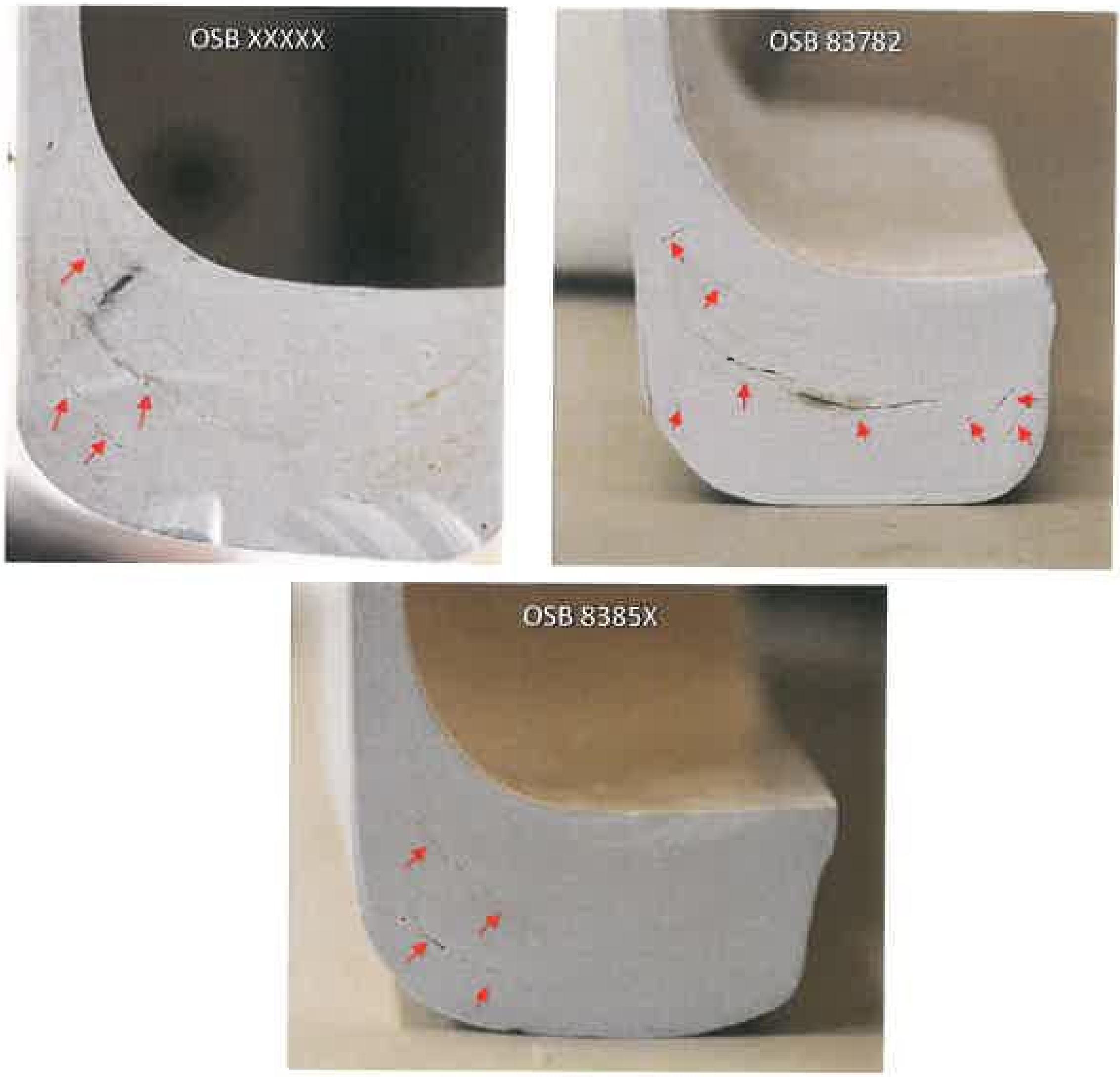

Figure 6. Unlaminated areas (marked with red arrows) in exemplar platform flanges.

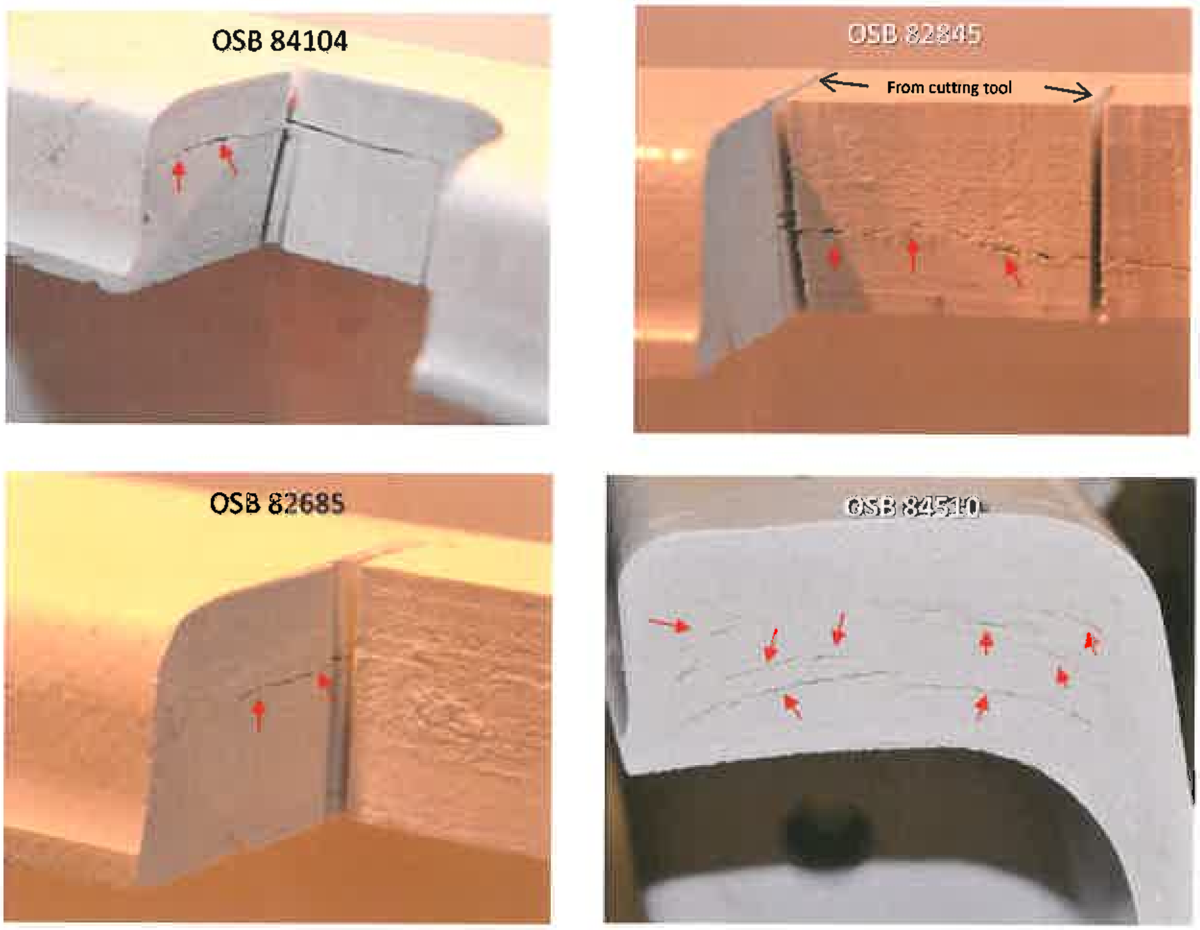

Figure 7. Unlaminated areas (marked with red arrows) in exemplar platform flanges.

Platform Performance Tests

Having presented no calculations or experiments, Mr. Eihusen failed to evaluate the structural significance of the unlaminated area in the subject platform. Exponent evaluated the structural significance of the unlaminated areas by performing load tests on an exemplar platform (OSB75752) that contained severe damage intentionally imparted in location A. Three tests were performed, at Osborne's facility and with Osborne's assistance.

In the first test, Exponent and Osborne made two cuts in the platform at location A, as shown in Figure 8. The cuts penetrate the thickness of the platform wall, rib, and flange. The cuts are much larger than any unlaminated area identified to date in this investigation. Exponent and Osborne mounted the platform on Osborne's test fixture, which replicates the platform mounting on the boom. We then hung 3,500 pounds of dead weight from the bottom of the platform (Figure 9). This applied load is five times the rated capacity of the platform and is approximately the weight of a typical midsize automobile. The load remained on the platform for several minutes, and the platform did not fail. The platform exhibited no sounds of cracking and no signs of impending failure.

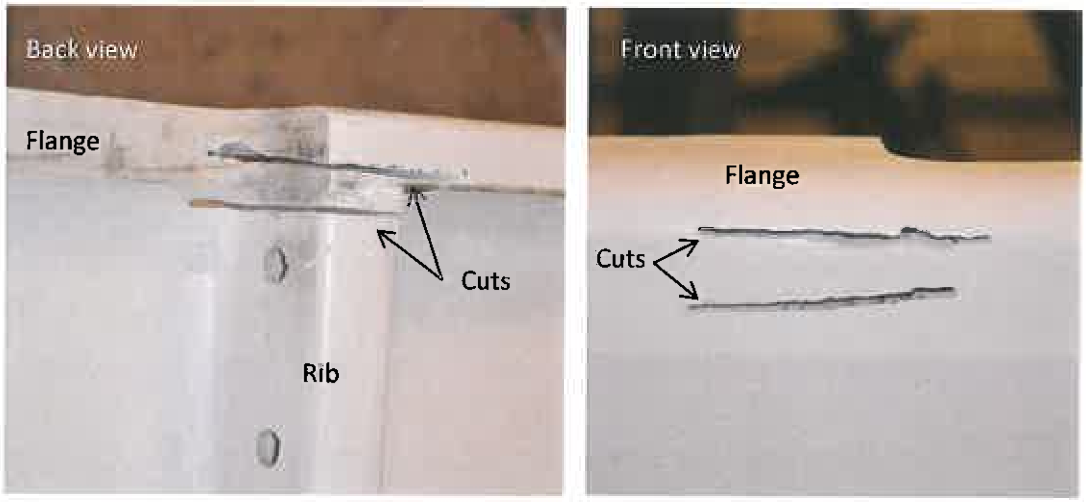

Figure 8. Damage imparted to location A in first test.

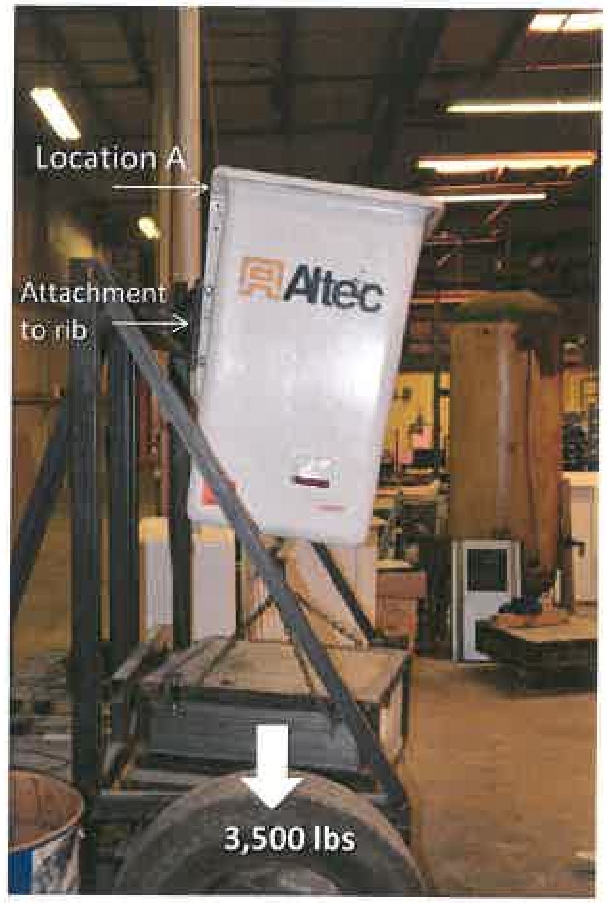

Figure 9. Intentionally damaged platform tested under 3,500 pounds of dead weight, which is five times the rated capacity of the platform.

In the second test, Exponent and Osborne removed all of the material between the two cuts, completely removing all material strength in the area in which Mr. Eihusen identifies the unlaminated area to be on the subject platform. This damage is shown in Figure 10. We then loaded the platform again with 3,500 pounds of dead weight and allowed the weight to remain on the platform for several minutes. Again, the platform did not fail and did not exhibit any sounds of cracking or signs of impending failure.

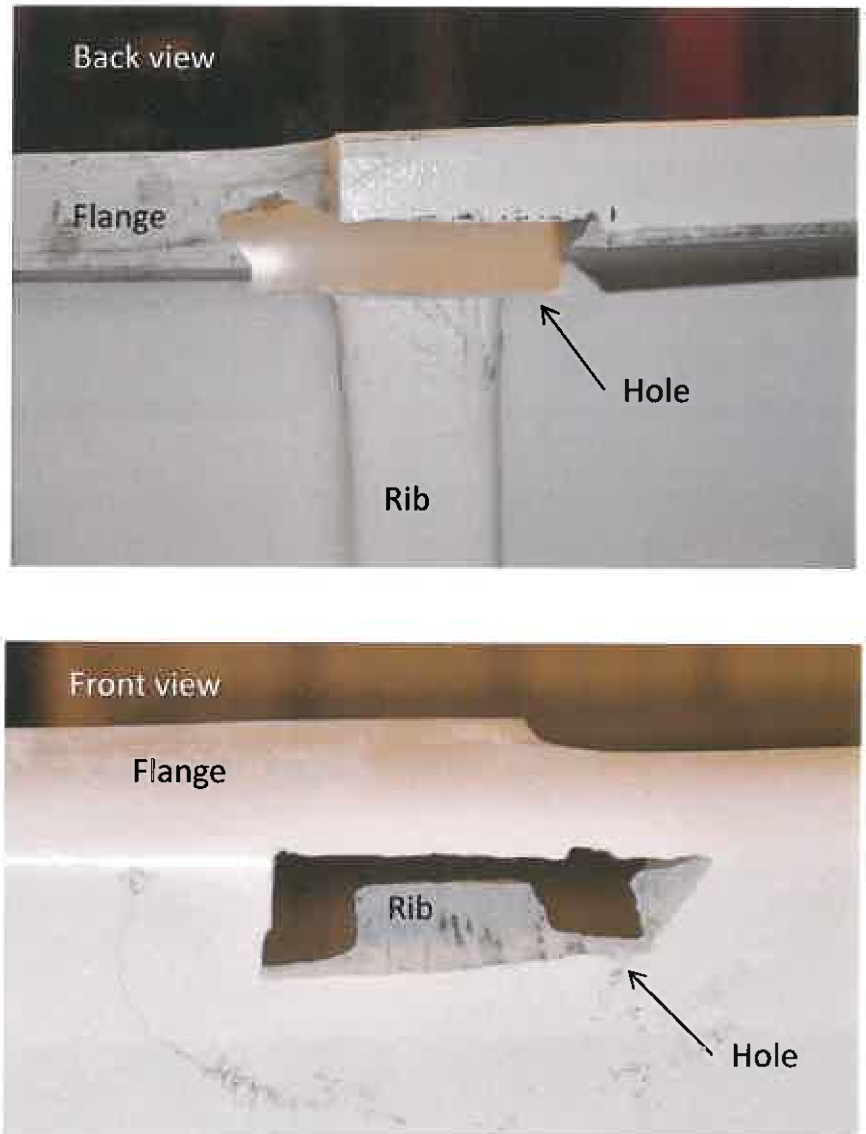

Figure 10. Damage imparted to location A in second and third tests.

These results show that there is no manufacturing feature at location A that is the cause of this incident. Mr. Eihusen claims that the unlaminated area at location A grew until failure. Yet our tests show that even if the feature grew to the point of completely removing all material strength at that location, the platform can still support not only its rated capacity but at least five times its rated capacity without failure.

The reason the platform can withstand such significant damage at location A without failure is that the stresses at that location are low relative to the rest of the platform, when the platform carries load on its floor. The primary load path is between the floor and the bolts that mount the platform to the boom, whereas location A is above this load path. To demonstrate this, Exponent performed finite element analysis of a -541 platform with 700 pounds distributed evenly across

the platform floor (using ABAQUS software). As shown in Figure 11, the high stresses are located between the platform floor and the mounting bolts, with the highest stresses located at the bottom of the ribs. Importantly, location A contains relatively low stress.[6]

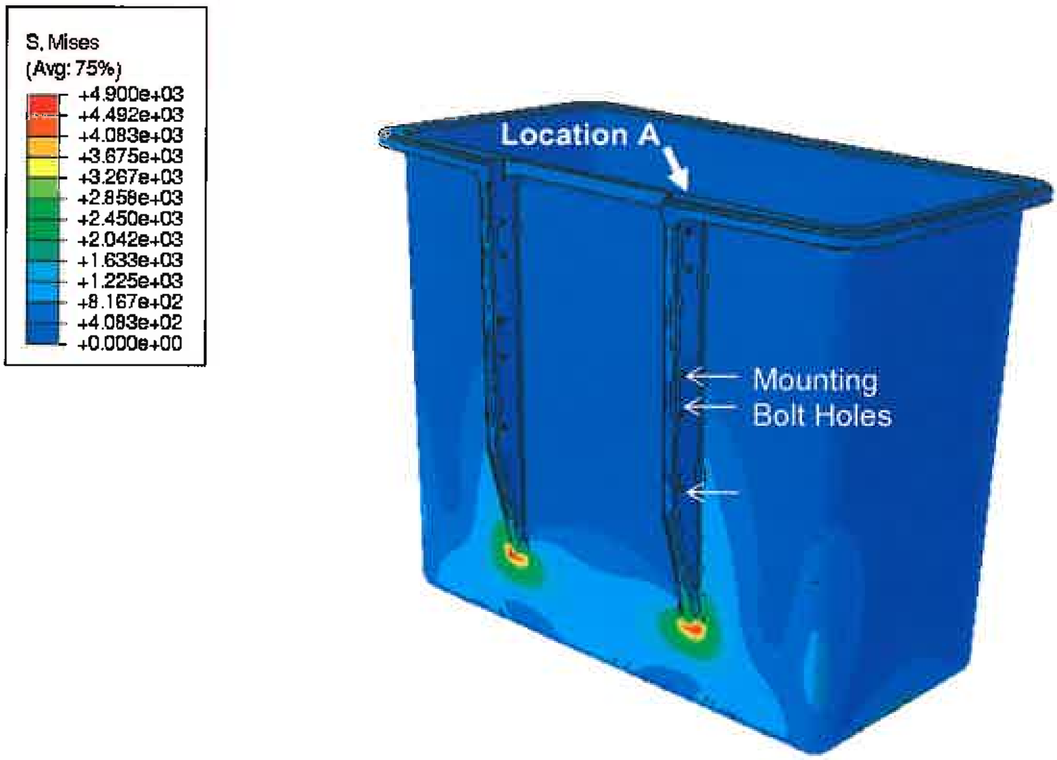

Figure 11. Stress contours of the -541 platform loaded with 700 pounds on its floor. The highest stress locations are at the bottom of the ribs (colored in red). Units are in psi.

Exponent performed a third test with the same platform that was involved in the first two tests, still containing the hole damage shown in Figure 10. In this third test, the platform was loaded with 700 pounds of dead weight hanging from the front right corner of the platform, as shown in Figure 12. This arrangement was selected to match the failure scenario tpresented by Mr. Ben Railsback, an expert accident reconstructionist retained in this matter by Wolfe, Snowden, Hurd, Luers & Ahl on behalf of Osborne Industries.[7]

The load was applied for several minutes, and the platform again completed the test without failing or generating any cracking noises or signs of impending failure. This result shows that the

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6 The purpose of this model is to demonstrate stress distribution on a relative basis, not to calculate absolute stress values. For this demonstration, linear elastic homogeneous material properties were assumed, using the Altec specified modulus of 1.39e6 psi.

7 Knott Laboratory Engineering Report, Keaschall vs Osborne Industries, Ben T. Railsback, June 23, 2016.

presence of unlaminated areas at location A could not have contributed to the failure of the subject bucket in Mr. Railsback's calculated scenario.

Figure 12. Platform tested under 700 pounds of dead weight on the front right corner of the flange.

Platform Fracture Surface Inspection

As shown previously, the majority of the platform separated from the truck, leaving the back wall of the platform attached to the boom. These two pieces are shown in Figure 13 and Figure 14. The flange fractured at two locations marked as A and B in Figure 13. Location A is where the flange and the right-side rib meet, and location B is at the back left corner of the platform. Location C is assigned to the corner between the front and left walls, where the fracture bifurcates.

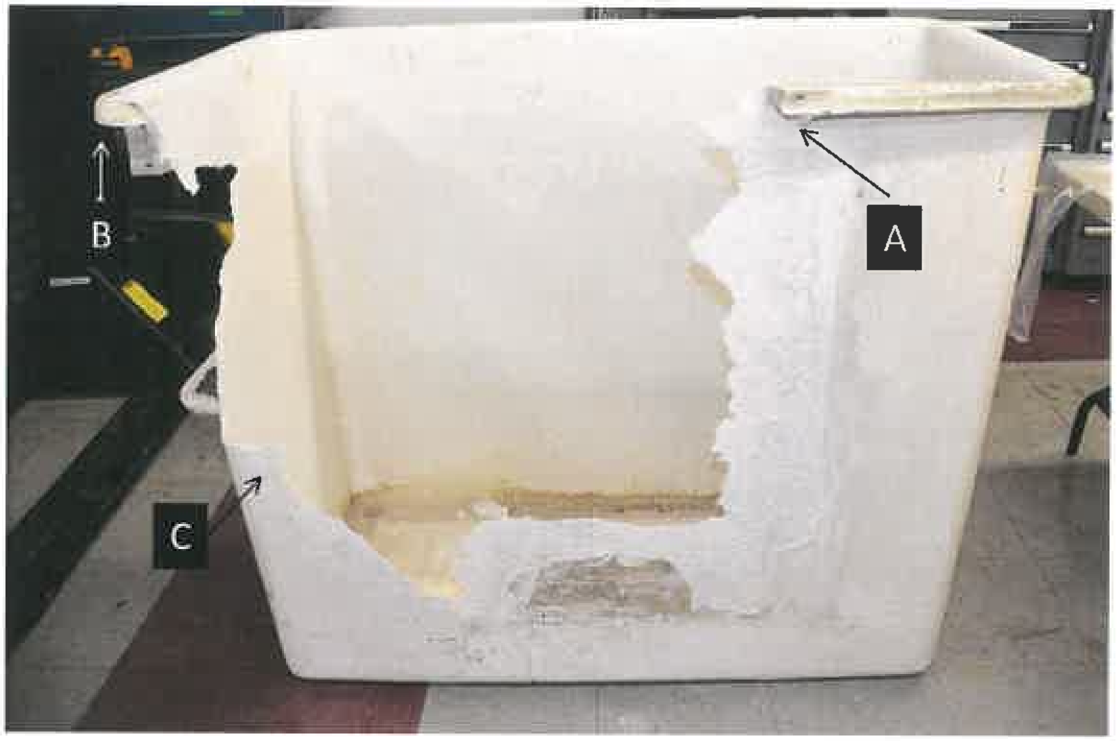

Figure 13. Subject platform.

Figure 14. Subject platform back wall.

The fracture at location A is shown in Figure 16 and Figure 17. The flange exhibits fibers protruding out of the fracture, indicating that this area failed in tensile overload. Near the bottom edge of the flange and at the intersection with the rib insert, the fracture surface changes to yellow and shiny. This zone is consistent with a pre-existing unlaminated location from manufacturing. The shiny appearance suggests that these surfaces were free, with limited or no contact with other surfaces.

When a delamination grows with repeated service loads, the newly created surfaces often rub against each other, becoming smooth and worn. The surroundings to the subject delaminated areas at location A are rough and fibrous, consistent with overload, and not growth with service loads.

Furthermore, inspection of the platform revealed evidence of one fracture origin located at the bottom of the right rib. This is consistent with the high stress location identified with FEA (Figure 11). Originating at the bottom of the rib, this fracture grew up toward location A, as shown in Figure 15. This evidence is inconsistent with Mr. Eihusen's illustration that the failure originated and is caused by features at location A.

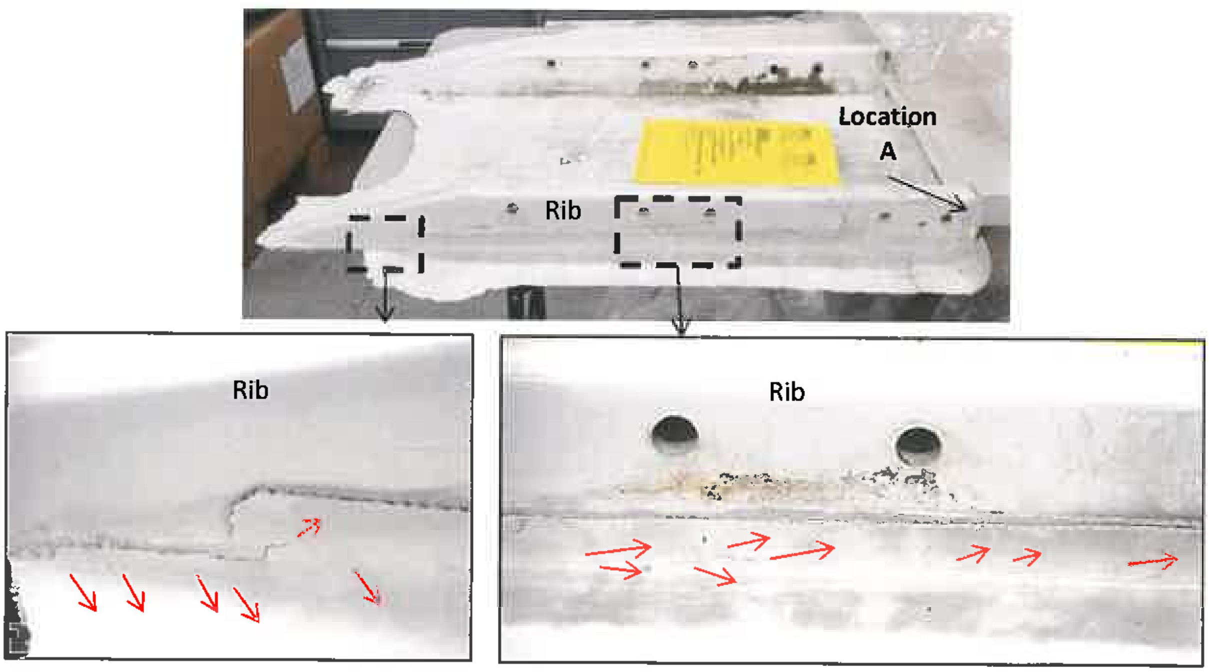

Figure 15. Fracture propagation on right-side rib.

Figure 18 and Figure 19 show the fracture surfaces at locations B and C, respectively. These surfaces are also rough and fibrous, consistent with overload failure.

The yellow area at location A, noted during the fracture surface inspection, was analyzed by gas chromatography–mass spectroscopy (GC-MS), Fourier transform infrared spectroscopy (FTIR), and differential scanning calorimetry (DSC). Based on these results, it appears that the yellow discoloration is likely the result of diphenylpropenone present in this location. This compound and its derivatives are characterized by a bright yellow color and are found as pigments in many types of yellow plants. The details of this analysis are found in Appendix A. We have not determined the exact mechanism by which this compound formed within the vinyl ester resin, but Exponent does not consider the compound to be relevant to the subject failure, as the platform performance tests show that the platform can support loads well beyond its rated capacity even with significantly damaged or missing material in location A, where this yellow compound was found.

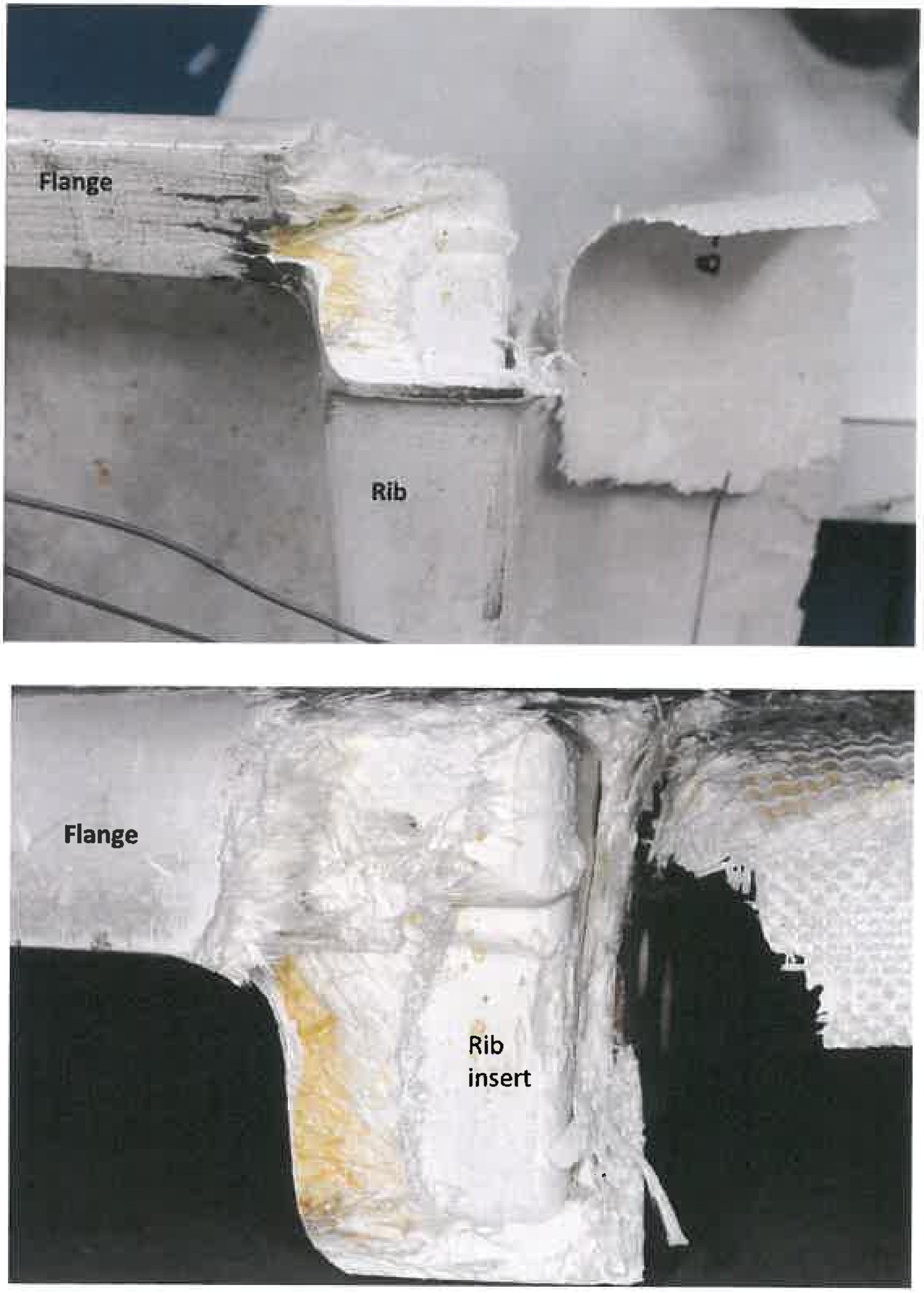

Figure 16. Fracture at location A, back wall portion.

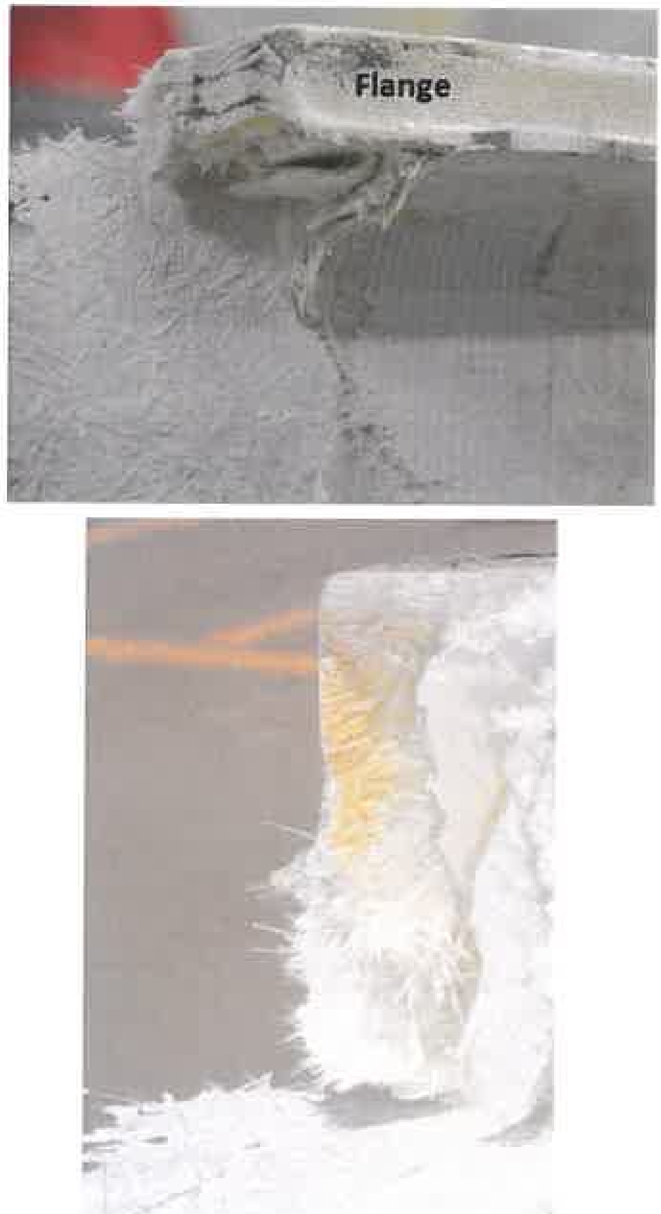

Figure 17. Fracture at location A, main platform portion.

Figure 18. Location B fracture.

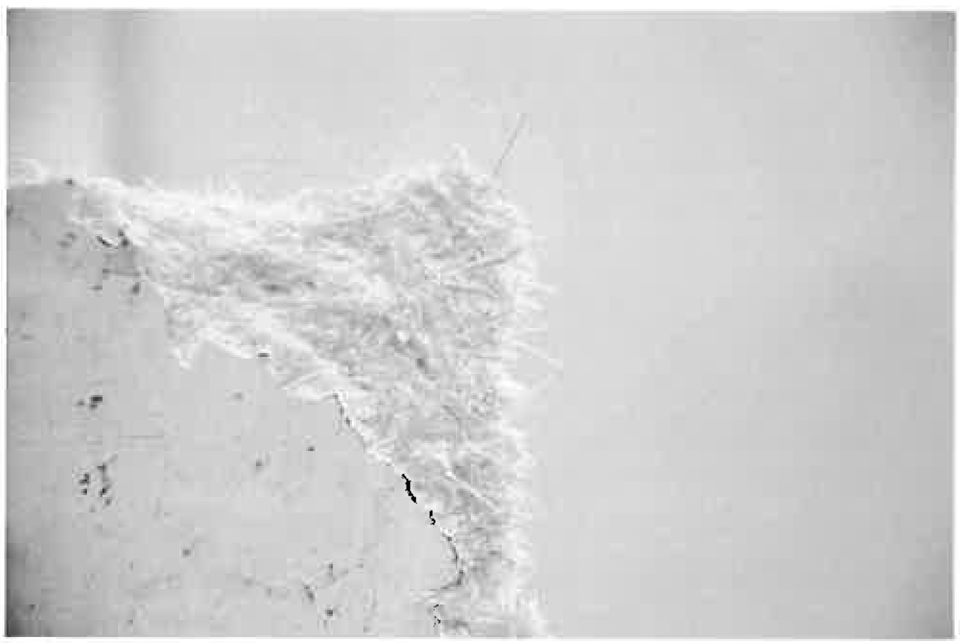

Figure 19. Location C fracture.

Discussion

Mr. Eihusen opines that the unlaminated area at location A is the root cause of the subject platform failure, but he fails to acknowledge that unlaminated areas are not unique to the subject platform. Rather, they are a common feature to the population of -541 platforms, as evidenced by nine out of nine inspected flanges containing this feature. Approximately 12,000 units were sold from 1999 to 2015, but only the subject platform failed catastrophically, indicating that the subject platform failed for a reason that Mr. Eihusen failed to identify.

In addition, Mr. Eihusen's theory is flawed because the -541 platform can carry load well over its rated capacity even with significantly more damage at location A than the unlaminated areas. Stress analysis of the platform under rated loading shows that the high stresses are located at the bottom of the ribs, and that the flange experiences relatively low stress.

The subject platform likely failed due to misuse involving loads beyond its rated capacity. This is supported by the fracture surfaces, which exhibit features consistent with overload failure.

Documents Received

Lexington Insurance Company Commercial General Liability Policy Declarations Page 2013-14

AEM Aerial Devices Safety Manual for Operating and Maintenance Personnel

Altec Self-Directed Sentry Operator Safety Training Workbook

Build Records (00070559)

Conrad Email

Dawson photos

Document 1: Complaint and Demand for Jury Trial, Filed 03/31/14

Altec Drawing 704-00065

Altec Drawing 704-0350

Altec Fiberglass Platform Construction, Procedure No. EN-241-P

Altec Maintenance and Parts Manual

Memo from Mr. Scott Fagot (Dawson Public Power) to Mike Moore (Altec Industries), June 12, 2012

Altec AA755L Operator's Manual

Plaintiff's Answers to Interrogatories of Osborne Industries, Inc., 1/27/15

PUN 201 2010A, Secondary Lanyard Attachment

Altec InstallBase Service Request Details

Sherman County Sheriff Department Photographs

Universal Inspections test report, 2/16/11

Deposition of Dean Kunkee

Deposition of Jeremy Kaiser

Deposition of Jerry Hobelman

Deposition of Joshua Chard

Deposition of Michael Moore

Deposition of Ryan McKinney

Deposition of G. Eakin

Deposition Index Template

Deposition Summary, Joshua Chard

Deposition Summary, George Eakin

Deposition Summary, Ryan McKinney

Deposition Summary, Michael Moore

Deposition Summary, Dean Kunkee

Deposition Summary, Jeremy Kaiser

Deposition Summary, Jerry Hobelman

Altec Bucket SN OSB39386 photos

Altec Bucket SNOSB62811 photos

Binder photos 2948 to 3032

Knott Lab Scans Ahl000–Ahl013

TR00141: NES Meeting Notes, 9/19/02

TR00141: Letter from Roger Burgoon (Altec) to M.C. Kent (Nashville Electric Service), 12/16/2002

Test Report TR00141

Test Summary TR00141

Summary Chart for TR00141 Test Report, Summary Chart for M.C. Kent Letter 021602 (Unit Platform Cross Ref)

TR00141: Test Setup

TR00141: NES Platform Photos

TR00141: Somat Data: Ultimate Test Data (Platforms A, A2, B, C, H, G, F)

TR00141: Test A Photos and Video

TR00141: Test A2 Photos and Video

TR00141: Test A3 Photos

TR00141: Test B Photos and Video

TR00141: Test C Photos and Video

TR00141: Test F Photos and Video

TR00141: Test G Photos and Video

TR00741 Photos and Video

TR00741 Summary

TR00741 Test Log Platform Performance

TR00741 Test Report

Drawing 9970047832jdo Platform Hole Locations

TR00822 Photos and Video

TR00822 Platform Performance Test Log

TR00822 Testing Matrix

TR00822 Test Summary

TR00822 Test Report

TR00835 Photos 6654–6668

Drawing 070412530-A

Drawing 970093702-A

Drawing 970174165-B

TR00835 Figure 24D-2

TR00835 Load Case 1, 2, 3 Photos

TR00835 Template Test Report

TR00835 Template Test Summary

TR00835 Test Log

TR00848 Photos

TR00848 Test Control Logic, Platform Load Test

Osborne Quality Notification Summary

TR00848 Procedure and Test Log

TR00848 Summary

TR00848 Summary Test 2

TR00848 Test Log and Procedure, Test 2

TR00848 Test Plan

TR00848 Test Report

TR00848 Test Report, Test 2

Drawing 704-00541 (Westar Platform)

TR01075 Accelerometer Installation Location Map (Uplander Platform Package Roading Test), pdf and PowerPoint files

TR01075 Test Log Uplander Platform Roading

TR01075 Test Plan

TR01075 Road Data Correlation End Hung

TR01075 Road Data Correlation

TR01075 Roading Accelerometer Parameters

TR01075 Summary

TR01075 Test Report

TR01075 Uplander Parts Decal

TR01075 Uplander Test Decal

TR01075 raw data, road data correlation template, and Uplander road data correlation

TR01075 Bad Data

TR01075 Run 1 and Run 2

TR01075 End Hung Files

TR01075: 220 Test images

TR01075 Photos and Videos (including for 217 Platform, 219 Platform, 220 Platform, and Setup)

TR01075 Beck Bounce Test Notes

TR01075, 217 Platform, Drilling and Mounting Boom Tips photos

DPPD photos

Affidavit (Motion to Compel) of Dr. Joseph Rakow in support of defendant Osborne Industries, Inc.

Knott Laboratory Engineering Report, Keaschall vs Osborne Industries, Ben T. Railsback, June 23, 2016

Coleman Evaluation Report

Doc 55 - Pltf's Brief In Opp to Def's Mtn to Compel-111115

Doc 56-2 - Affidavit of John Eihusen-111115

Eihusen draft report (Appendix A 3.3.16)

Eihusen Findings 092615

Exhibits 1-20

Exhibits 21-44

Exhibits 100-112

Unit Sales-Platforms

Keaschall Destructive Testing Protocol 10-2-15

Keaschall Inspection Protocol 7-8-15

Pltf Keaschall's Supplemental Expert Witness Disclosures

Pltf's ATI to Osborne 1.27.15

Sample Collection Recommendations and EDS Description

VIDEO_TS

AUDIO_TS

ANSI A92.2

Appendix A

Compositional Analysis of Extracted Samples

During inspection of the subject platform, areas of localized yellowing were observed on the platform at location A. To investigate potential compositional differences in the composite resin near the fracture surface and in the yellowing areas, four samples were extracted from the device for material and chemical analysis. Three samples (labeled Sample A-01 to A-03) were taken from the fractured region at location A and were chosen based on the yellow color intensity of the resin. Sample A-01 showed the most extensive yellowing, and Sample A-03 showed the least yellowing of the three samples. Sample C was taken in a non-yellowed region at location C and was used as a control for compositional comparison. Table A1 provides a list of samples, and Figure A1 shows photographs that identify the location of sample removal.

Table A1.Samples analyzed from the lift device.

Sample	Information
Sample A-01	Yellowed resin from fracture area (most yellow) at location A
Sample A-02	Resin sample taken near yellowed area at location A
Sample A-03	Non-yellow resin sample taken from fracture area at location A
Sample C	Control resin sample (taken at location C)

Figure A1. Sample locations at location A (Samples A-01 to A-03) and the control (Sample C).

Fourier transform infrared (FTIR) spectroscopy[1] was used to attempt to identify compositional differences among the three samples taken from the fracture surface and the control sample. Figure A2 shows the FTIR spectra for all of the four samples stacked for comparison. All four spectra are consistent with a vinyl ester resin composed of unsaturated polyester with phthalate groups as determined by absorbances at 1720, 1250, 1100 and 730 cm^{-1}. The FTIR is also consistent with added styrene in the formulation based on absorbances at 1490, 750, and 700 cm^{-1}. In general, few obvious material chemistry differences are observed among the four resin samples. In Sample A-02, absorbances associated with the vinyl ester are diminished and absorbances associated with talc are observed at ~3700 and 1000 cm-1.

Differential scanning calorimetry (DSC)[2] was also used to investigate possible differences in thermal transitions of location A and location C, which might be indicative of compositional variation in the resin. DSC analysis of Samples A and C showed few differences in both the first and second heating scans, and the glass transition temperature (recorded during the second heating scan) was nearly identical (67 and 68 °C for Samples A and C, respectively), indicating similar material composition, and curing. Decomposition profiles were also shown to be similar by thermogravimetric analysis (TGA),[3] further suggesting few material composition differences between samples taken at the fracture surface and the control sample.[4]

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1 FTIR is a spectroscopic technique that identifies compounds based on absorbance of IR radiation by groups of atoms. FTIR can assist in the identification of materials and can provide a comparative assessment of chemical differences among samples. In this case, attenuated total reflectance (ATR)–FTIR was performed, so spectral data are collected a few microns into the sample surface.

2 DSC analyzes thermal transitions in a polymeric material and uses comparative measurements of heat flow to probe molecular events, including glass transition, crystallization, and melting.

3 TGA is a thermal analysis technique that measures changes in material mass loss as a function of increasing temperature. It can provide physical and chemical information relating to solvent/water loss and material decomposition.

4 It should be noted that TGA was performed for the purpose of identifying compositional differences of resin. It was not performed for the purpose of identifying glass content in the platform. The samples were small, localized, and intentionally resin-focused; they are not intended to be representative of the glass content throughout the platform.

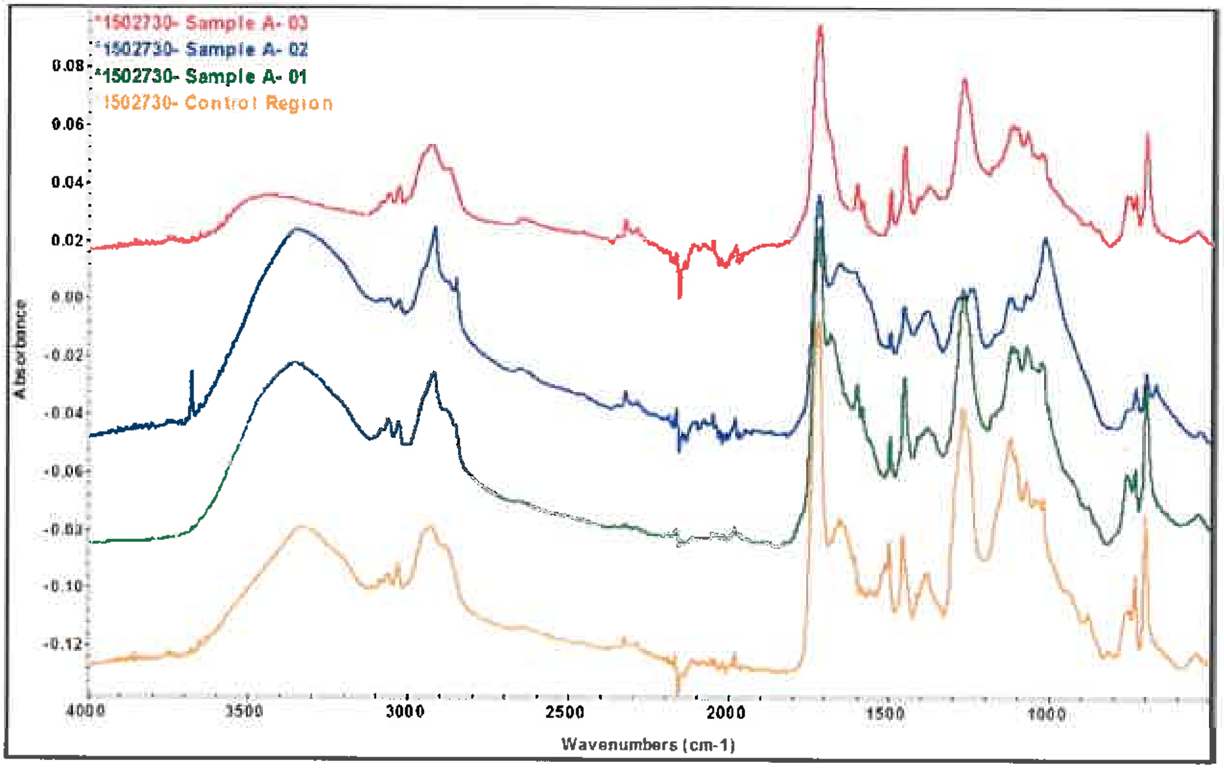

Figure A2. FTIR spectra collected from Samples A-01, A-02, A-03, and Sample C (control).

Exponent performed an organic extraction to dissolve and identify small molecule compounds within the vinyl ester resin that might be responsible for the yellow color. Sample A-01 (most yellow), Sample A-02 (less yellow), and the Sample C (control) were extracted with hexane: acetone (1:1 v/v) with sonication for 10 minutes. Each extract solution was analyzed by direct injection using gas chromatography–mass spectrometry (GC-MS).

The most abundant compound found in Sample C and Sample A-02 was 2,2,4-trimethyl-1,3-pentanediol diisobutanoate, the solvent carrier for MEKP. In fact, the compound was abundant in all three samples tested, which suggests that peroxide initiator was present in all of the areas sampled for GC-MS analysis. Five compounds that are unique to Samples A-01 and A-02, the samples that exhibit yellow discoloration, are listed in Table A2. Of these compounds, diphenylpropenone (also known as chalcone) was present in the highest abundance in both samples and is likely responsible for the yellow color. Diphenylpropenone and its derivatives are characterized by a bright yellow color and are found as pigments in many types of yellow plants.[5] We have not determined the exact mechanism by which this compound formed within the vinyl ester resin.

[5] Davies, K.M., Bloor, S.J., Spiller, G.B., Deroles, S.C. "Production of yellow color in flowers: redirection of flavonoid biosynthesis in Petunia," *The Plant Journal* (1998) **13**(2), 259–266.

Table A2. Unique compounds identified in yellow samples A-01 and A-02.

GC Retention Time (min)	Component ID (NIST Library Match)
8	Diphenylbutenone
8.16	Diphenylpropenone
8.32	Hydroxyphenethyl benzoate
8.4	Acetyloxyphenyl Ethanone
8.86	Dibenzoylethane

Appendix B

Résumé of Joseph F. Rakow, Ph.D., P.E.

Exponent®
Failure Analysis Associates®

Exponent
149 Commonwealth Drive
Menlo Park, CA 94025

telephone 650-326-9400
facsimile 650-326-8072
www.exponent.com

Joseph F. Rakow, Ph.D., P.E.
Principal Engineer

Professional Profile

Dr. Joseph Rakow is a Principal Engineer in Exponent's Mechanical Engineering practice. Dr. Rakow advises clients on complex engineering problems from design, manufacturing, and qualification, to field use and field failures, with particular expertise in failure analysis. He leads diverse multi-disciplinary investigations to deliver scientific answers to clients' technical problems. Dr. Rakow has expertise in the areas of mechanical, structural, and aerospace engineering, with extensive experience involving a wide variety of devices and components: gas, steam, and wind turbines; aircraft and spacecraft; pumps, tanks, and pipelines; cars and trucks; cranes and lifts; consumer products; sporting equipment; and a variety of civil structures. Dr. Rakow employs laboratory experimental methods supplemented with theoretical and numerical analysis to identify and illustrate scientific solutions for clients.

Dr. Rakow has published a number of scientific articles and is frequently invited to present at national and international technical conferences, where he is well known for the failure analysis of composite structures. He is a contributing author to the International Civil Aviation Organization (ICAO) *Manual of Accident and Incident Investigation*, having contributed the chapter on composites. He teaches introductory composites courses to professional engineers through the American Society of Materials. He is also a Visiting Lecturer in the Aeronautics and Astronautics Department at Stanford University. Prior to joining Exponent, Dr. Rakow held teaching and research positions at the University of Michigan and Sandia National Laboratories. As a volunteer, Dr. Rakow is a structural specialist with FEMA Urban Search & Rescue.

Academic Credentials and Professional Honors

Ph.D., Aerospace Engineering, University of Michigan, 2004
M.S., Aerospace Engineering, University of Michigan, 2000
B.S., Physics, University of California, Davis, 1999

Top Conference Paper, International Society of Air Safety Investigators, 2006
Best Student Paper Award, American Institute of Aeronautics and Astronautics, 2004
Rollin M. Gerstacker Graduate Research Fellowship, University of Michigan, 1999
Citation of Excellence in Physics, University of California, Davis, 1999

Tau Beta Pi Engineering Honor Society; Sigma Pi Sigma Physics Honor Society

Licenses, Certifications, and Training

Registered Professional Mechanical Engineer, California, #M33403
Registered Professional Civil Engineer, California, #C76562

Class A California commercial driver's license with doubles/triples and air brake ratings (expired)
NAUI certified SCUBA diver
University of Southern California Aircraft Accident Investigation Course
FEMA Urban Search and Rescue Program, Structure Specialist

Patents

Patent No. 7814597: Method and Apparatus For Determining Cloth And Fluid Motion In A Washing Machine, October 2010 (with J.M. Fife and A. Starkie).

Patent No. 8080498: Elastic Hollow Particles for Annular Pressure Buildup Mitigation, October 2009 (with P.D. Pattillo and J.E. Shepherd).

Patent Application No. 60/791,279: Convectively Cooled Sandwich Panel for Structural and Heat Exchange Applications, April 2006 (with A.M. Waas).

Publications

Rakow AS, Edmonds JS, Rakow JF, Brody RD. Root cause failure analysis of a 373 megawatt steam turbine generator exhibiting both reversible and irreversible thermal sensitivity. Proceedings, ASME 2011 Power Conference, July 2011.

Rakow AS, Caflisch ML, Rakow JF. The role and process of machinery root cause failure analysis. Proceedings, Machinery Failure Prevention Technology Conference, April 2010.

Rakow JF, Pettinger AM. Failure analysis of composites: Sandwich structures. Adv Mater Processes 2009; 167(8):24-26, August.

Rakow JF, Pettinger AM. Failure analysis of composites: Laminate behavior. Adv Mater Processes 2009; 167(7):16-18, July.

Rakow JF, Pettinger AM. The emergence of composite aircraft: An introduction for aviation attorneys. Proceedings, SMU Air Law Symposium, February 2009.

Rakow JF, Pettinger AM. Failure analysis of composite structures in aircraft accidents. ISASI Forum, January-March 2007, p.17-23.

Rakow JF, Pettinger AM. Failure analysis of composites: A manual for aircraft accident investigators. First Edition, International Society of Air Safety Investigators, 2007.

Rakow JF, Waas AM. Response of actively cooled metal foam sandwich panels exposed to thermal loading. AIAA Journal 2007; 45(2):329-336.

Rakow JF, Waas AM. Thermal buckling of metal foam sandwich panels for convective thermal protection systems. J Spacecraft Rockets 2005; 42(5):832-844.

Rakow JF, Waas AM. Size effects and the shear response of aluminum foam. Mech Mater 2005; 37(1):69-82.

Rakow JF, Waas AM. Thermomechanical response of actively cooled metal foam sandwich panels for thermal protection systems. Paper #2005-1953, AIAA Structures, Structural Dynamics, and Materials Conference, Austin, TX, April 2005.

Rakow JF, Waas AM. The response of actively cooled metal foam sandwich panels to thermal loads. Symposium on Materials and Structural Systems for Hypersonic Vehicles, ASME International Mechanical Engineering Conference, Anaheim, CA, November 2004.

Rakow JF. Thermomechanical response of metal foam sandwich panels in structural thermal protection systems for hypersonic vehicles. Ph.D. Dissertation, University of Michigan, Department of Aerospace Engineering, 2004.

Rakow JF, Waas AM. Thermal buckling of metal foam sandwich panels for actively cooled thermal protection systems. Paper #2004-1710, AIAA Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA, April 2004.

Rakow JF, Waas AM. Size effects in metal foam cores for sandwich structures. AIAA Journal 2004; 42(7):1331-1337.

Rakow JF, Waas AM. The effective isotropic moduli of random fibrous composites, platelet composites, and foamed solids. Mech Adv Mater Struct 2004; 11(2):151-173.

Rakow JF, Waas AM. Size effects in metal foam cores for sandwich structures. Paper#2003-1946, AIAA Structures, Structural Dynamics, and Materials Conference, Norfolk, VA, April 2003.

Rakow JF, Waas AM. Shear deformation of aluminum foam produced by the melt route. Paper#P033, EuroFoam, Manchester, U.K., July 2002.

Selected Presentations

Rakow JF. An interactive case study on composite failure analysis. MS&T, Columbus, OH, October 2011.

Rakow JF. The role of manufacturing in solving composite product failures. Composites, Las Vegas, NV, February 2010.

Mitchell EA, Schwall ML, Rakow JF. Bicycle failure analysis and product liability. Interbike, Las Vegas, NV, November 2009.

Caflisch ML, Rakow JF. Failure analysis and reliability of wind turbines. Windpower, Chicago, IL, May 2009.

Rakow JF. Thermostructural failure in aviation-related accidents and incidents. Annual Conference of the International Society of Air Safety Investigators, Fort Worth, TX, September 2005.

Rakow JF, Waas AM. Thermomechanical response of metal foam core sandwich structures for hypersonic vehicles. Symposium on Materials and Structural Systems for Hypersonic Vehicles, ASME International Mechanical Engineering Conference, Washington, D.C., November 2003.

Rakow JF, Waas AM. Shear response of metal foams. Annual Meeting of the Society of Engineering Science, Ann Arbor, MI, October 2003.

Rakow JF, Waas AM. Metal foam sandwich structures for crashworthy applications. Automotive Composites Consortium, Ann Arbor, MI, November 2002.

Rakow JF. Bounds on elastic moduli for composite materials and metal foams. Sandia Summer Seminar Series, Livermore, CA, August 2001.

Rakow JF, Dike JJ. A comparison of inter-element continuity of stress-based quantities in hex and the finite element schemes in DOE in-house codes. Sandia Summer Seminar Series, Livermore, CA, August 2000.

Invited Presentations

Rakow JF. Tutorial: Investigating composite structures. International Society of Air Safety Investigators, Vancouver, Canada, August 2013.

Rakow JF, et al. Failure analysis: The science of what went wrong. ASME Professional Development Seminar, Santa Clara, CA, March 2013.

Rakow JF. Resolving marine claims with engineering and science. International Union of Marine Insurance, Paris, France, September 2011.

Rakow JF. Failure analysis of satellite components. Space Systems/Loral Bob Dodd Seminar, Palo Alto, CA, February 2009.

Rakow JF. Failure analysis of composite structures in aircraft accidents. Symposium on International Challenges in the Investigation of Air Accidents under Safety Management Systems, Santiago, Chile, November 2007.

Rakow JF. MRO and NDT: Managing damage and failure in composite aircraft structures. Swiss Re Center for Global Dialogue, Zurich, Switzerland, January 2007.

Rakow JF, Pettinger AM. Failure analysis of composites in aircraft accidents. New York City Bar Association, Aeronautics Committee, January 2007.

Rakow JF. Structural instabilities in advanced aerospace structures-Experimental and analytical techniques. Invited Speaker, NextGen Aeronautics, Torrance, CA, August 2004.

Rakow JF. Development of an advanced structural thermal protection system for aerospace vehicles. Invited Speaker, Aerospace Corporation, El Segundo, CA, April 2004.

Book Chapters

Rakow JF, Pettinger AM. Chapter 9. Structures Investigation: Composite Materials. Manual of Aircraft Accident and Incident Investigation, Part III, International Civil Aviation Organization, Doc 9756-AN/965.

Television

"Hijack," Surviving Disaster, Freemantle Media, October 2009.

"Plastic Planes," Dan Rather Reports, HDNet, September 2007.

"MythBusters: Shredded Airplane," Discovery Channel, September 2005.

"Coming Home: The Science of Re-entry," Discovery Channel, May 2003.

Editorships and Editorial Review Boards

- Working Group Chair, Composite Materials Handbook CMH-17
- Reviewer, Journal of Composite Structures
- Reviewer, Fatigue and Fracture Technical Committee, Society of Experimental Mechanics

Professional Affiliations

- American Society of Mechanical Engineers
- American Institute of Aeronautics and Astronautics
- American Society of Materials
- International Society of Air Safety Investigators

Appendix C

Deposition and Trial Testimony

Deposition and Trial Testimony, Past Four Years

Trials and Arbitrations

1. *Hilltop Ranch Inc. v. Buhler Barth GmbH,* International Chamber of Commerce, International Court of Arbitration, Paris, France, ICC Cases No. 20774/RD, April 2016.

2. *Rick Pratt v. Easton Technical Products, et al.,* Court of Common Pleas, Stark County, Ohio, Case No. 2011CV02511, June 2013.

Depositions

1. *Woody Contracting, Inc. v. Kaman Corporation, et al.,* United States District County for the District of Connecticut, Case No. 3:12-CV-01010-AVC, October 2014.

2. *Rick Pratt v. Easton Technical Products, et al.,* Court of Common Pleas, Stark County, Ohio, Case No. 2011CV02511, May 2013.

3. *David Aguado v. Time Manufacturing, et al.,* Superior Court of New Jersey, Law Division – Atlantic County, Docket No. ATL-L-8778-11, May 2013.

4. *Bronco Professional Park v. Tina Dhillon, Clovis Valley Plumbing, et al.,* Superior Court of California, County of Madera, Case No. MCV050582 with MCV054745, January 2013.

5. *Shrodric McGee v. Anheuser-Busch; Seaworld; Bolliger & Mabillard; et al.,* District Court of Bexar County, Texas, Cause No. 2009-CI 12376, September 2012.

Appendix D

Compensation

Compensation

My hourly billing rate for 2016 is $430, as set by my employer, Exponent, Inc.

Appendix E

Exhibits

Exhibits

I have not yet prepared exhibits for trial.

Investigative Report

Keaschall (Julie), et al. V. Altec Industries, et al.
ESI Project: 47413A

EXHIBIT
I

4215 Campus Drive
Aurora, IL 60504

Investigative Report

Keaschall (Julie), et al. V. Altec Industries, et al.
ESI Project: 47413A

Report Prepared for:

Mr. Robert W. Shively
Shively & Lannin, PC, L.L.O
4400 S. 86th Street, Suite 100
Lincoln, NE 68526

Submitted by:

June 27, 2016
Date

Anand R. Shah, M.S., M.B.A. P.E.
Senior Managing Consultant
IL P.E. | Expires: November 30, 2017

Technical Review by:

June 27, 2016
Date

Pierce D. Umberger, Ph.D.
Senior Staff Consultant

Introduction

Engineering Systems, Inc. (ESI) has been retained by Robert W. Shively, of Shively & Lannin, P.C, L.L.O. to provide materials engineering consulting related to a litigation matter in the United States District Court, District of Nebraska, titled Keaschall v. ALTEC Industries, Inc. (Altec) and Osborne Industries, Inc. (Osborne), Case No. 4:14-cv-03070. The matter arises from a failure of a fiberglass platform that occurred on June 6, 2012.

ESI is a professional engineering and consulting firm and a laboratory headquartered in Aurora, Illinois. ESI is a multi-disciplinary company, which provides professional engineering services to industrial, legal and insurance firms, government agencies and trade organizations, and provides consulting to other engineering firms. The laboratory capabilities are supplemented by cooperative agreements with other recognized facilities to provide a wide range of technical support capabilities, including metallurgical, materials, mechanical, aeronautical, structural, civil, electrical, safety, automotive and audio/visual services. Projects ranging from simple failure investigations to complex engineering studies are undertaken.

ESI's investigation focused on the root cause for the failure of a fiberglass platform on a Dawson Public Power District (Dawson Power) truck. ESI's investigation included review of the incident scene photos, examination of the subject fiberglass platform, testing of the subject fiberglass platform, as well as examination and testing of other exemplar fiberglass platforms, a review of technical reports authored by Plaintiffs' experts, a review of discovery documents, and review of other relevant technical literature.

This report details the findings and opinions expressed by Anand R. Shah, M.S., M.B.A, P.E., pertaining to the engagement described above. This report summarizes the opinions reached and the basis for those findings. ESI reserves the right to clarify or supplement this report, if warranted, as new information becomes available. Attached hereto are the curricula vitae of Anand R. Shah, M.S., M.B.A., P.E., which set forth pertinent qualifications and experience, and list the technical presentations and publications authored (Appendix A). Also attached is a listing of depositions and trials wherein expert testimony has been given over the last four years (Appendix B). ESI currently bills Mr. Shah's time at $325 per hour for research and analysis in this matter.

Report figures, photographs, video, excerpts from literature and other materials reviewed may be utilized at the time of trial as demonstrative exhibits.

Background

The subject truck, Dawson Power vehicle number 3505 was a 2005 model year International 7300, VIN 1G2HX54KXY4195606, fitted with an Altec AA-755 aerial lift device and fiberglass two-man side-hung 700 lb capacity platform, serial number OSB39386.[1,2,3] The at-issue vehicle was ordered by the Dawson Public Power District on or about November 16, 2004.

Witnesses indicate that the decedent, Kurtis Keaschall, was in the platform bucket decommissioning a utility pole on June 6, 2012, when the platform separated from the boom.[4] Mr. Keaschall was wearing a fall protection device, but the device lanyard had not been attached to the anchor point on the lift boom. Both ends of the lanyard appeared to be intact and attached to the D-ring at the back of the fall protection harness.[5]

The exact mileage of the vehicle at the time of the incident is not known, however, upon return to the Dawson County storage facility, the vehicle odometer indicated 93,975 miles. Precise maintenance history for the vehicle and equipment is not known, but the truck bears an inspection sticker from Consolidated Fleet Services, Inc., with a date of February 15, 2012.

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[1] Sherman County Sheriff Incident Report I1206-03-0

[2] Altec purchase order 5549, dated November 16, 2004

[3] Altec specification sheet for PO 5549, undated

[4] Sherman County Sheriff Incident Narrative I206-03

[5] Sherman County Sherriff Photos, dated June 6, 2012

Basis for this Report

This report is based on a review of the documents listed below, and on the inspections conducted as indicated below. The education and experience of the author also served as a basis for this report.

Received Documents

- Affidavit of Joseph Rakow in Support of Osborne Industries' Motion to Compel Discovery;
- Affidavit of John Eihusen (Plaintiff Expert) in Response to Osborne Industries' Motion to Compel and attached Exhibit A;
- Memorandum and Order filed December 21, 2015;
- John A. Eihusen's draft report dated March 3, 2016;
- Protocol for Destructive Testing of the Subject Platform dated February 19, 2016;
- Deposition of Amy Conrad dated February 17, 2015, with Exhibits;
- Deposition of Michael David Moore dated April 2, 2015;
- Deposition of George Eakin dated February 17, 2015, with Exhibits;
- Deposition of Joshua Chard dated April 2, 2015;
- Deposition of Ryan McKinney dated April 2, 2015;
- Black light photos of bucket received from the Attorney for Dawson Public Power District;
- X-ray imagery of failed bucket received January 20, 2016;
- FARO scans taken by Ben Railsback, Knott Laboratory, July 13, 2015;
- Altec test reports received July 6, 2015;
- Inspection photographs taken July 22, 2014 (unknown source);
- Photographs taken at site by Dawson Public Power District (DPPD) June 12, 2012;
- Inspection photographs taken by Mike Moore June 8, 2012 (Deposition Exhibit);
- Photographs taken at site by Sherman County Sheriff June 6, 2012;
- Any and all photos taken and information gathered on the inspections that took place July 13, 2015, April 27, 2016, and June 17, 2016;
- Altec Protective Order dated December 5, 2014;
- Altec Responses to RFP dated October 13, 2014;
- Altec Supplemental Responses to RFP dated December 31, 2014;
- DPPD Responses to RFP dated May 19, 2015;
- Affidavit of John Eihusen dated November 11, 2015;
- Osborne Responses to RFP dated January 14, 2015;
- Affidavit of Joseph Rakow dated November 17, 2015;
- Complaint filed March 31, 2014;
- Altec Service Records;
- Sherman County Sheriff Report dated June 11, 2012;
- Ravenna Fire Rescue Records dated June 6, 2012;
- Protocol for Destructive Testing of the Subject Platform dated July 8, 2015;
- John Eihusen report dated September 26, 2015;
- William Coleman report dated September 30, 2015;
- AEM (Assn of Equip Mfrs) Aerial Devices Safety Manual (1998);
- Altec Operator's Manual (2004);
- Altec Maintenance and Parts Manual (2004);
- Altec Self-Directed Sentry Operator Safety Training Workbook (2012);
- EN-241-P Altec Fiberglass Platform Construction Procedure rev. 2014-01-28;

- Drawing 704-00065 (Mold) 1986-08-16 (rev G 2006-09-29);
- Drawing 704-0350 (Fiberglass) 1993-08-03 (rev F 2008-11-19);
- PUN 2010A, Secondary Lanyard Attachment (2010-07-23);
- Altec Build Records;
- Medical Records from Good Samaritan (2012-06-06)
- Summary Report from Mike Moore dated June 12, 2012
- Altec Document Production
- Osborne Document Production
- Plaintiffs Document Production
- Supplemental Protocol for Destructive Testing of the Subject Platform dated October 2, 2015
- MAI Sample Collection Recommendations and EDS Description
- Plaintiffs' Expert Witness Disclosures dated September 30, 2015

Review of Scene Photos

ESI reviewed the scene photos taken on June 6, 2012 by Sherman County Sheriff's department. Select photos are discussed here to provide relative orientation information of the objects and details of the incident. Photos 1 and 2 show the incident scene from two different positions. The Dawson truck was found positioned parallel and in close proximity to the pole as shown in Photo 1. The truck outriggers are extended stabilizing the truck and the boom was extended. The bottom and top boom are oriented and extended such that the platform front (away from the rib attachment) would have been facing away from the front of the truck. In the lower right corner of Photo 1, the final rest location of the subject platform can also be observed.

Photo 2 shows the subject platform completely in view as well as the orientation of the truck, and the pole. Additionally, the damaged railing above the rear tire on the driver side of the Dawson Power truck can also be observed. Prior to landing on the ground, the platform impacted a horizontal rail located above the rear tire on the driver side of the truck causing it to bend as shown in Photos 3 and 4. Based on red paint markings on the exterior surface of the platform, the location of the impact on the platform was at the right-hand side front corner, if one was in the platform and facing towards the front of the platform (away from rib attachment side). In Photo 5, the side of the platform that remained attached to the aerial lift is shown from two vantage points.

Photo 1: Incident scene photo taken by Sherman County Sheriff's department.

Photo 2: Incident scene photo taken by Sherman County Sheriff department.

Photo 3: Incident scene photo taken by Sherman County Sheriff's department. The damage to the horizontal railing from impact of the falling platform is shown. The railing is located on the driver side of the truck above the rear tire of the truck.

Photo 4: Incident scene photo taken by Sherman County Sheriff's department. A close up of the damage to the horizontal railing.

Photo 5: Incident scene photos taken by Sherman County Sheriff's department. The portion of the platform that remained attached to the aerial lift and relative orientation of the aerial lift to the pole and truck is shown.

Based on the review of the scene photos, it is concluded that the fiberglass platform fractured and separated from the rib side and travelled in the direction of the truck at a velocity that resulted in sufficient impact force to bend the railing before reaching the ground.

Inspection of Subject Platform

The subject platform was inspected by ESI on July 13, 2015 at a storage facility in Lincoln, Nebraska, and again on April 27, 2016 at the Exponent Laboratory in Menlo Park, California. All parties were present at both of the inspections. As shown in Photo 6 and apparent from the scene photos, the platform exhibited a separation of the mounting rib side from the platform. The imprint on the rib side of the platform indicated that the Platform serial number was OSB39386. The fracture initiated in the area of the rim, adjacent to the mounting rib, shown in Photo 7. Although a number of surface cracks exist in this area, it is clear that the fracture occurred relatively close to the bottom of the rim. The surface cracks appear to have existed at the time of the incident and the crack opening displacement appears not to have changed in the accident. A paper label adhering to outer surface of the fractured rib side provided the following product information:

Altec Part Number 070400541
Quantity 1
Supplier: Osborne Industries
PO Number 31712
Release 244

Container#B21505
Supplier Part: FC-135410
Ship To:
Altec Industries, Inc. 093- Midwest Aerial Mfg.
2106D S. Riverside Road
St. Joseph, MO 64507

On April 27, 2016, a joint inspection was held in a laboratory to examine the fracture morphology at three locations and perform material analysis on the fiberglass reinforced plastic material of the platform. All parties agreed to cut out smaller samples to facilitate examination and testing at locations identified as “A”, “B”, and “C” in Photo 8. A small piece from area marked as “A” was cut during the inspection on April 27, 2016 and examined both in optical and scanning electron microscope. It was observed during cutting of a small sample at this location that the surface micro-cracks visible in Photo 7 do extend several inches along the rim of the platform, as shown in Photo 9.

A Scanning Electron Microscope (SEM) was used to obtain images of the fracture locations identified as “A” and “B”. SEM images shown in Photos 10 and 11 of the fracture from location “A” and location “B” reveal a fracture surface morphology that is indicative of overload failure of the platform. Photo 11 shows number of glass fiber ends that fractured in the cracking of the platform. The fracture surface morphology is consistent with tensile overload failure at location “B”. There is proper adhesion between the fiber and matrix material. There is no evidence of fiber pull out. At location “A” the fracture morphology shows fibers that run mostly parallel to the crack surface indicating fracture occurred in shear. As will be discussed later in this report, the location of the failure and the observed damage on the subject platform is consistent with the location of failure observed in a side-load testing of similar platform conducted by Altec in 2002.

Photo 6. Subject platform without the fractured rib section (left) and with the fractured rib section (right).

Photo 7. Fracture initiation region at rim in vicinity of mounting rib. (Side view (left). Bottom view (Right))

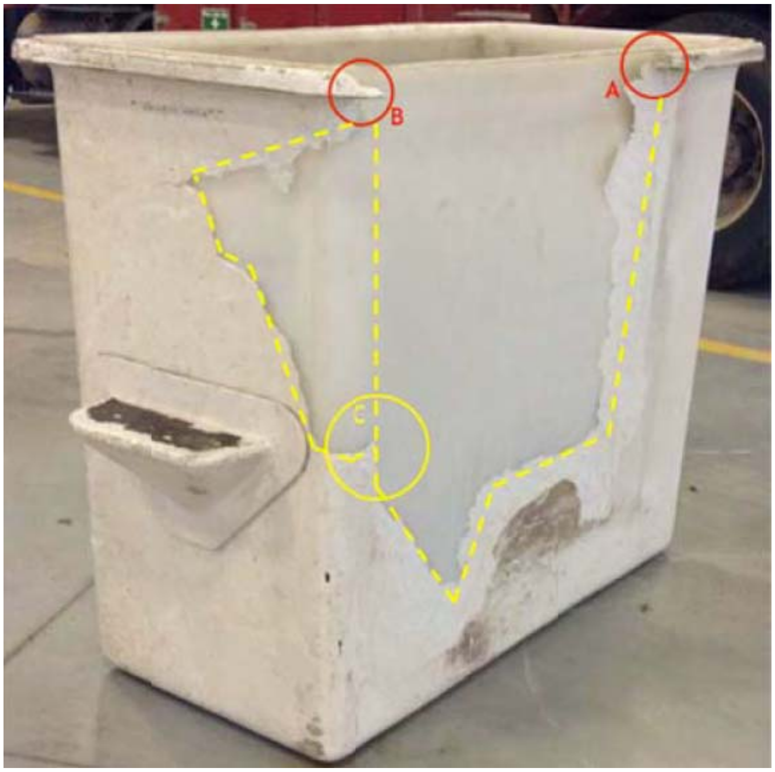

Photo 8: Locations of interest marked as “A”, “B”, and “C”.

Photo 9: Cut location and polished cross-section few inches from the fracture at location “A”.

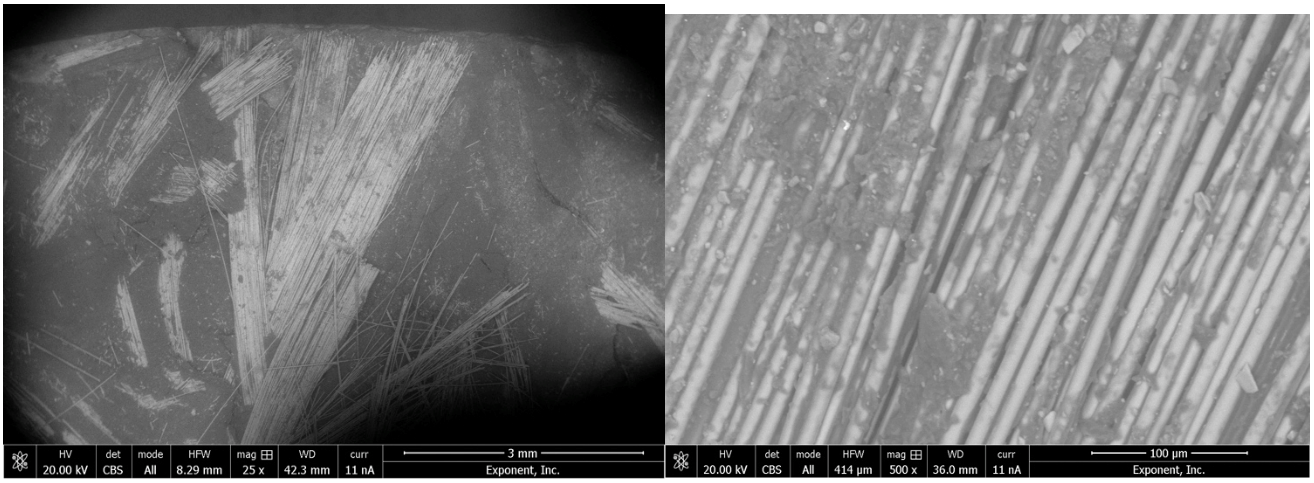

Photo 10: Fracture at location "A" shows cracking developed along fibers due to shear loading.

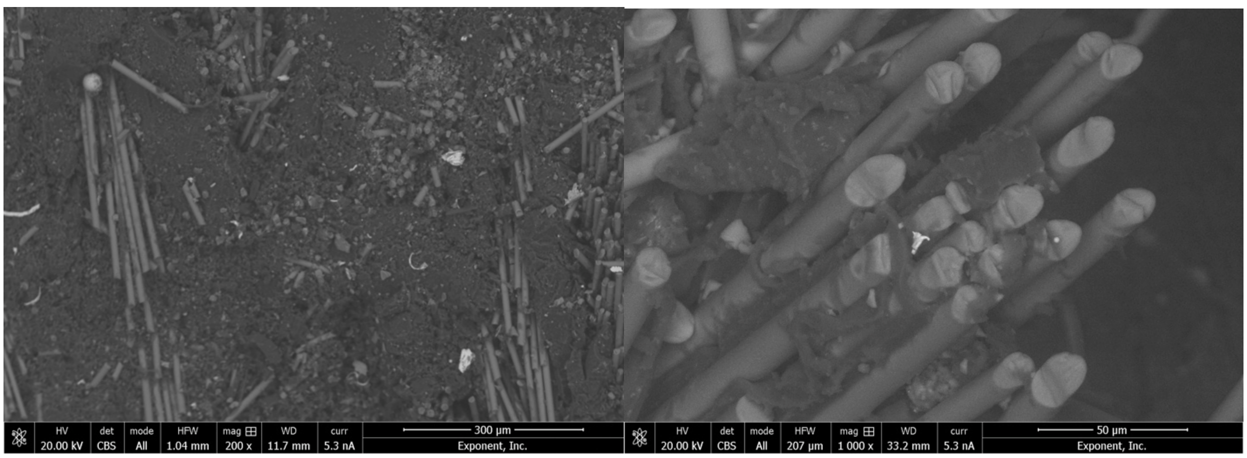

Photo 11: Fracture at location "B" shows fractured ends of glass-fiber reinforcement.

The fiberglass material from the subject platform was subjected to Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA). The resin used in the subject platform was listed as "CORESYN" [sic] in the platform inspection report.[6] It is possible that this refers to CoREZYN, a commercially available line of resins commonly used for composite manufacturing. The material characterization in FTIR is consistent with an ester resin such as CoREZYN. FTIR analysis was also performed on yellow debris present at location "A". FTIR analysis suggested that the yellow debris is similar in its chemical composition to the clear white resin material tested at location "C".

The weight percentage of glass fiber was measured at the fracture location "A" and "C" by heating a sample in TGA up to 600 C. The weight percentage of glass fiber at location "A" and "C" was 16.1% and 13.7% respectively. Significant experimental error of the weight percentage of glass fiber is expected using this test method, as only milligrams of sample is tested and the test sample is taken from a fractured area that has been exposed to

[6] OI00033, Osborne Industries Aerial Platform Inspection Report, dated March 29, 2005

environment. For accurate determination of the weight percentage of glass fiber a representative sample of full cross-section would have to be tested. The examination of the platform, the laboratory material testing, and the high-magnification documentation of the fracture surface morphology provided evidence to conclude that composite material failed from overloading experienced by the platform.

Inspection of Exemplar Platforms

On June 17, 2016 ESI traveled to Altec Nueco in Ft. Wayne, Indiana for examination and testing of exemplar platforms. ESI examined and tested platforms from two trucks equipped with AA755 type aerial lift. The platforms were identified as Altec Part #07040054. Altec's records indicated that the platforms had been in service for approximately 1.5 and 4 years.

The platforms were closely inspected for any signs of cracking near the rim and at rib connections. One truck with ID# 95-37164530 had a platform with serial # OSB78768. Altec records indicated that although the truck was a 2007 model International 43000 DT466, the platform had an approximately 1.5 year service history. A second truck with ID#95-39175735 had a platform with serial # OSB62187. Altec records indicated that although the truck was a 2007 model International 4300DT 466, the platform had an approximately 4 year service history.

Photos 12 and 13 show that similar to the subject platform both of these exemplar platforms had small surface cracks at the rim in the vicinity of the rib connection. This observation indicates that surface cracking observed on the subject platform is a common occurrence for platforms as a result of service.

After a visual examination, both exemplar platforms were tested with 1050 lbs of vertical load. A vertical force of 1.5x the load capacity of the platform was applied to the platforms as shown in Photos 14 and 15. Based on review of the documents this is one of the requirements in the ANSI 92.2 standard and performed on all Altec trucks. The 1050 lbs of force, which is 1.5x the 700 lbs. rating of the platform, is significantly higher than that would be expected under normal use conditions. Prior to loading the platforms, a Dillon Dynamometer with 10,000 lbs capacity with 50 lbs increments was used to verify that the weight in the test was 1050 lbs. The two platforms tested resisted 1050 lbs of force for up to 5 minutes of loading without any signs of failure. The platforms were inspected after the vertical load test and there was no visible crack opening of the surface cracks present, nor any gel coat damage or cracking of any kind observed.

Subsequently, the platform side with the ribs was cut from the platform and X-ray images were obtained of the rim section above the mounting ribs. The X-ray images of these two exemplar buckets are provided in Photos 16-19. The X-ray images revealed the presence of the same features in the rim of these two platforms that the Plaintiffs have documented in the subject and in another exemplar platform removed from service by Dawson Power. As discussed below, the accurate description of these features is discontinuities or flaws and not manufacturing defect since their presence has no direct effect on the ability of the platform to carry loads well in excess of its design load.

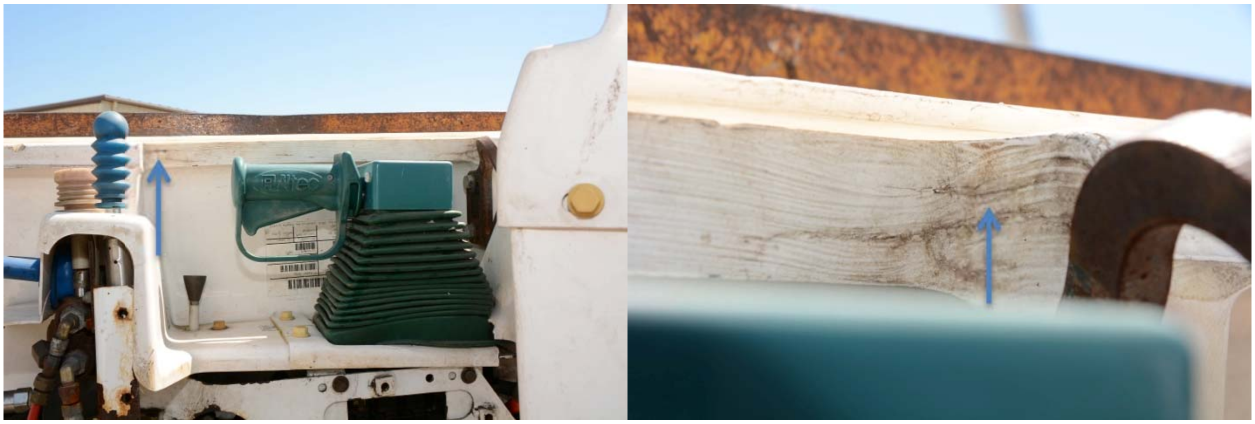

Photo 12: A view of the top rim of the bucket just above the mounting ribs that exhibited surface micro-cracking in platform marked as OSB62187.

Photo 13: A view of the top rim of the bucket just above the mounting ribs that exhibited surface micro-cracking in platform marked as OSB78768.

Photo 14: Vertical static load test of 1050 lbs applied for 5 minutes on exemplar OSB 62187 fiberglass platform.

Photo 15: Vertical static load test of 1050 lbs applied for 5 minutes on exemplar OSB 62187 fiberglass platform.

Photo 16: OSB 78768 Platform X-ray image.

Photo 17: OSB 78768 Platform X-ray image.

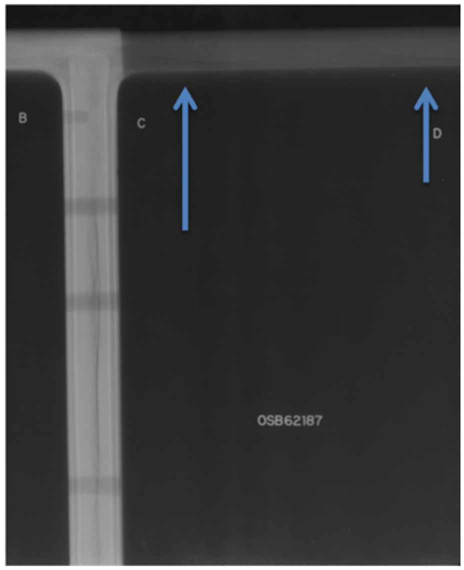

Photo 18: OSB 62187 Platform X-ray image.

Photo 19: OSB 62187A Platform X-ray image.

The Plaintiffs' experts allege that similar features which are present in the subject platform are manufacturing defects that contributed to the failure of the subject platform. However, as demonstrated by the current testing, these features are present on other Osborne manufactured platforms that are in service and with them present the platform is able to carry at least 1.5x the load capacity.

According to ASM Materials Engineering Dictionary[7], a defect is defined as a (1) discontinuity whose size, shape, orientation, or location makes it detrimental to the useful service of the part in which it occurs. It further explains (2) that a discontinuity or discontinuities which by nature or accumulated effect (for example, total crack length) render a part or product unable to meet minimum applicable acceptance standards or specifications.

A discontinuity is defined as (1) any interruption in the normal physical structure or configuration of a part, such as a cracks, lap seams, inclusions, or porosity. A discontinuity may or may not affect the utility of the part. It further states that a discontinuity is not necessarily a defect.

Thus, the observed surface cracking and subsurface delamination are not defects but discontinuity and its presence does not affect the utility of the part.

Discussion

1) Platform Requirements

The Fiberglass reinforced plastic material and platform specification are provided by Altec in Altec document titled "Fiberglass Platform Construction"[8]. The origin date of this document is May 22, 1986. Altec specified the fiberglass reinforced plastic material for the platform to meet the following properties:

Barcol Hardness using 934 scale	45 to 55
Flexural Strength	17500 PSI
Flexural Modulus	.74 x 10 E6
Tensile Strength	6350 PSI
Tensile Modulus	1.39 x 10^6 PSI
24 hour water absorption rate	.129% (By Weight)
Glass to resin ratio	26%

The tensile strength, flexural strength, and modulus, as well as other constitutive properties that are specified are typical and in line with fiberglass composite materials frequently used in industry.[9] In terms of composite

[7] ASM Materials Engineering Dictionary edited by J. R. Davis, Copyright 1992

[8] Altec Fiberglass Platform Construction Specification EN-241-P

[9] MFG Companies Technical Design Guide for FRP Composite Products and Parts, p. 22

homogeneity and finish requirements, Altec specifies that the platform must be constructed without voids, dry spots, or resin rich regions.[10]

Altec also specifies that platforms meet or exceed an ultimate strength test of 12 times their load capacity (8,400 pounds in the case of the at-issue platform) before final failure of the platform.[11] This requirement is well in excess of the regulatory requirements set forth in ANSI A92.2, which requires stresses in the platform remain at 20% or less of their ultimate strength value[12], effectively a load factor of 5 as opposed to Altec's specification of 12. A side load strength of minimum of 500 pounds are also required, with damage to the gel coat allowed, but other structural damage forbidden.[13] As discussed later, the designed platform exceeds the side load strength requirement by significant margin.

Altec practices testing of 100% of completed units in compliance with ANSI A92.2 and conducts a stability test with the platform loaded to 150% (1.5X load capacity) of its design rated load.[14] Individual platforms are received from Osborne and installed after passing a visual inspection.[15]

2) Prior Platform Testing by Altec

Review of testing data provided by Altec showed that a number of tests in various loading directions on a platform identified as TR-00141 was performed in 2002. The TR-00141 type platform (model 704-00541)[16] is similar to the subject platform. The platforms tested by Altec in 2002 passed all the qualification testing requirements.[17] The data is summarized in Table 1 below.

Platform	Ultimate (lbs.)	Safety Factor	Test Description
A	6,900	8.6	Loaded downward at center of platform.
A2	11,700	14.6	Loaded downward at center of platform.
B	4,400	Na	Loaded upward at center of platform.
C	11,500	14.4	Loaded downward at center of platform.
H	2,300	Na	Loaded horizontally at lip of platform.
G	2,200	Na	Loaded horizontally at lip of platform.
F	3,900	Na	Loaded downward at outside lip of platform.

Table 1: Results of Altec Testing of Platforms TR-00141 in 2002.

[10] Altec Fiberglass Platform Construction Specification EN-241-P, sections 2.4.3 – 2.4.4

[11] Altec Fiberglass Platform Construction Specification EN-241-P, section 2.2.3

[12] ANSI A92.2-2001, *American National Standard for Vehicle-Mounted Elevating and Rotating Aerial Devices*, Section 4.2

[13] Altec Fiberglass Platform Construction Specification EN-241-P, section 2.2.2

[14] Deposition of Joshua Chard, dated April 2, 2015, pp. 29-30

[15] Deposition of Ryan McKinney, dated April 2, 2015, p. 24

[16] Altec Test Report Summary Sheet for Test Report TR-00141, dated December 13, 2002

[17] Tr00141 Test Report NES 705-00541 Platform Test 12-13-02

Additionally, Altec specifies a non-destructive quality assurance test for platform strength, prescribing a load of 3 times the rated load (2,100 pounds total in the case of the at-issue platform) be placed within the platform. Absolutely no damage, including gel coat cracking is allowed.[18,19] Long-term durability testing in which repeated loading is applied was also conducted by Altec on similar platform as the subject platform. It was found that no damage or cracking resulted from repeated loading of 100,000 cycles at twice the platform's rated load capacity.[20]

3) Side loading of Exemplar Platform

In side loading test described as Test G in Table 1 above, the fracture occurred in the same location as that in the subject platform. The fracture in side loading test is shown in Photo 20.[21] The plot of the force required for this failure is shown in Photo 21 and indicates that force in excess of 2000 lbs is required for the failure.

A side load applied to the platform can generate substantial bending moments in regions of the platform rim and rib, depending on the location and magnitude of the applied side load. A moment, generated when an applied force is reacted over a distance, known as a "moment arm" generates bending in the structure, illustrated schematically in Photo 22. In the case of the at-issue platform, a moment arm of up to 24 inches can generate bending moments of 2 ft-lb for every 1 lb of applied load. The fixed point of the ribs mounted to the boom assembly reacts both the sideways load, as well as the bending moment at a fixed point. This same bending moment is also present in the corners of the platform rib, and is consistent with gel coat cracking observed in the corners of both subject and side-loaded exemplar platforms. (Photos 23 and 24) While not inspected by ESI, the subject vehicle was inspected by Michael Moore of Altec. Spiral cracking was noted on the fiberglass boom, which – while not a structural issue in and of itself – can be an indicator of previous overloading of the boom and/or platform.[22]

Based on the information reviewed Altec Part #07040054 platform manufactured by Osborne Industries has been tested to ensure that failure does not result from normal loading of the platform in service. The platform is rated for a load capacity of 700 lbs and testing of similar platforms has shown ultimate strength well in excess of the specified ultimate strength requirement of 8400 lbs. which is 12x the load capacity.[23] Reportedly, Altec is not aware of any platform failures due to material defects, but is aware of a multitude of failures due to overloading of the platform.[24] Additionally, the extent of fracture which resulted in complete separation of the rib side, the platform has to have experienced excessive side loading and did not fail from normal operating loads. The county sheriff's report notes that the boom was approximately 3 feet from the utility pole at the time of the accident, "with the bucket present it would have been closer."[25].

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[18] Altec Fiberglass Platform Construction Specification EN-241-P, section 2.3.2

[19] Deposition of Joshua Chard, dated April 2, 2015, pp. 36-37

[20] Deposition of Joshua Chard, dated April 2, 2015, pp. 110-111

[21] Altec Platform Test TR00141, Test G

[22] Deposition of Michael Moore, dated April 2, 2015, pp. 33-34

[23] Summary for Test Report TR-00141 NES 704-00541 Platform Test

[24] Deposition of Ryan McKinney dated April 2, 2015 p. 16.

[25] Sherman County Sheriff Incident Narrative I206-03

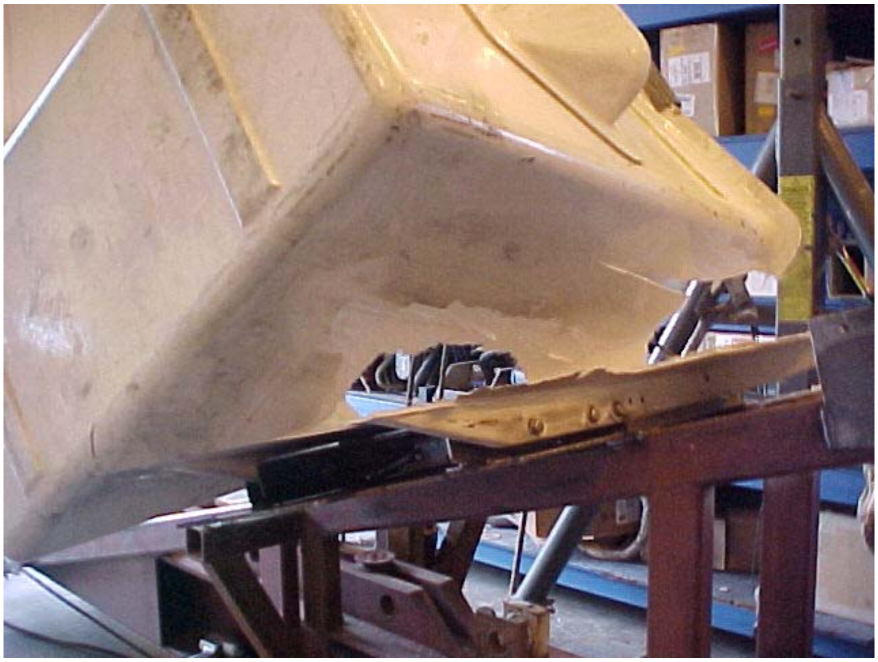

Photo 20. Platform test TR00141, Test G after side load failure.

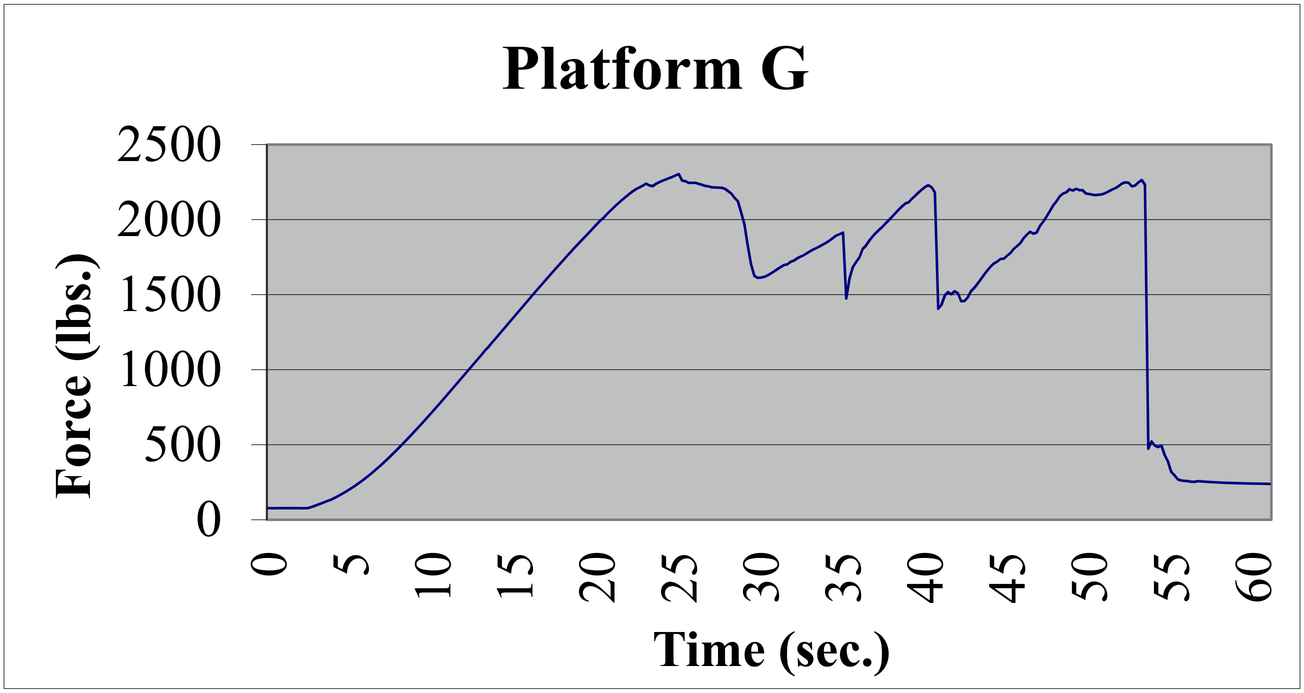

Photo 21: Graph of the force in lbs. required for ultimate strength test when platform is side loaded

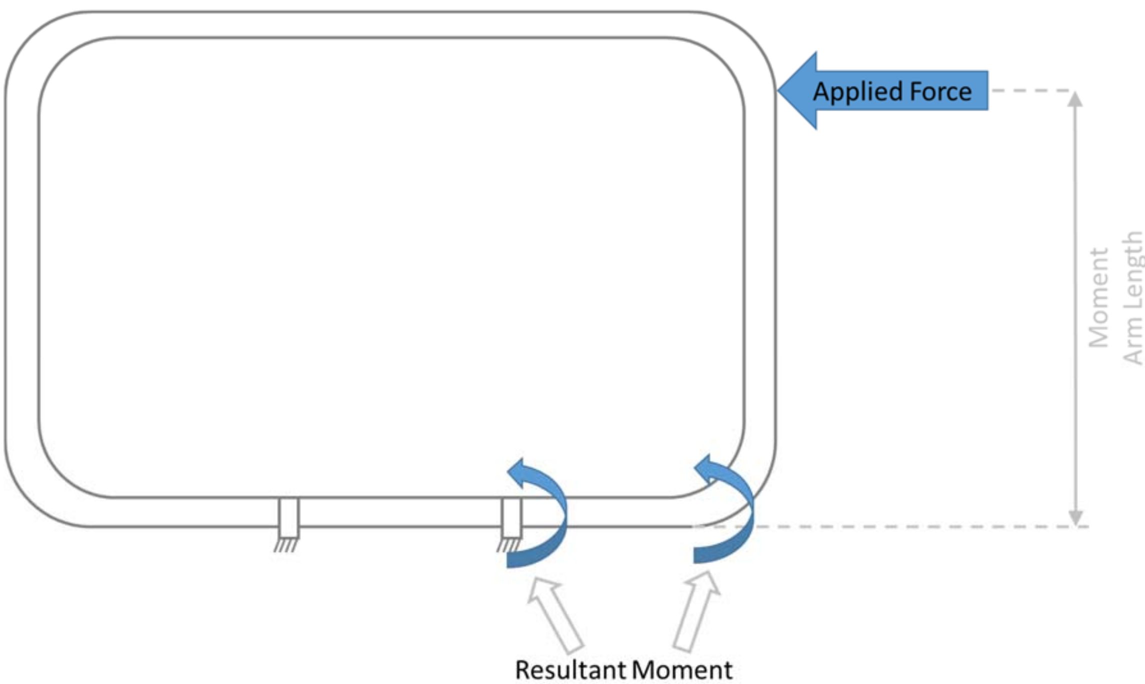

Photo 22: Schematic illustration of moment generated at platform corner and rib due to side loading.

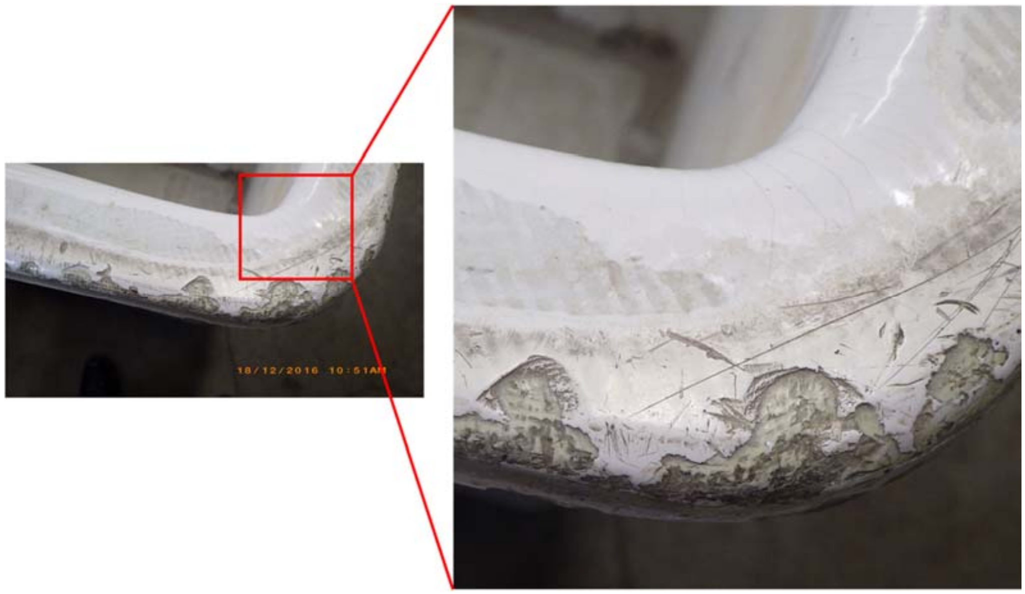

Photo 23: Corner cracking of subject platform consistent with non-vertical loading. Similar cracking was observed at other corners.

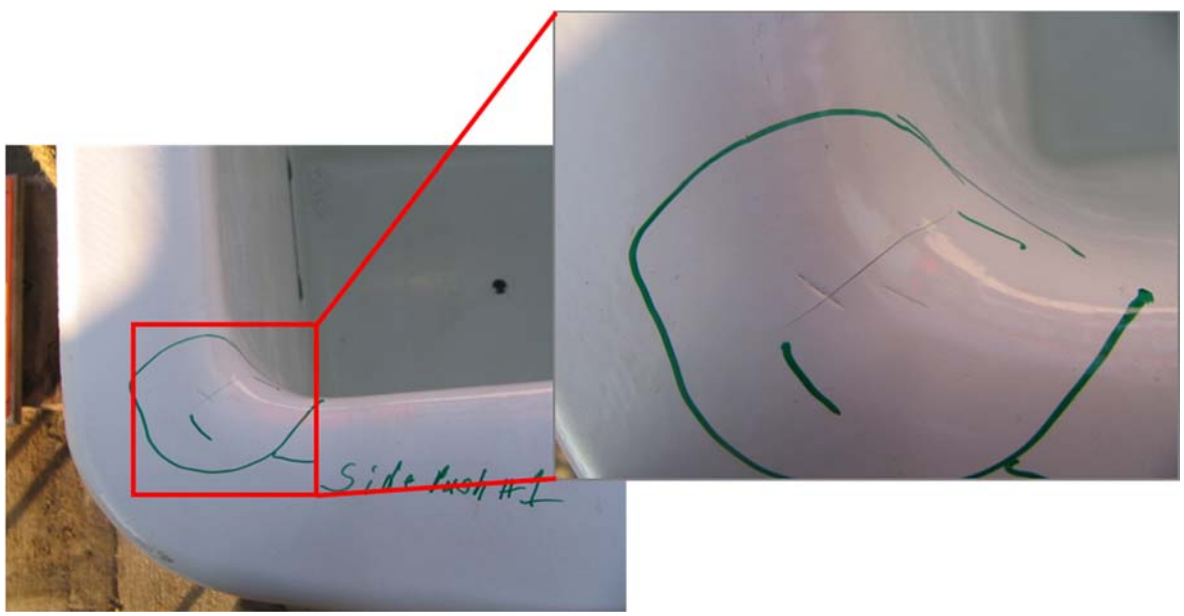

Photo 24: Side load damage during test of Altec Platform 1928.[26]

[26] Altec Test Report for Platform 1928, TR00822

Review of Expert Reports

1) Review of William R. Coleman, M.S., P.E Analytical & Materials Engineering, Inc. reported dated September 30, 2015

   ESI has reviewed a report authored by William R. Coleman of Analytical & Materials Engineering Inc., and ESI does not agree with the 5 opinions offered by Mr. Coleman as discussed below.

   In regards to Mr. Coleman's opinion #1 there is no evidence to support that "inherent manufacturing defects have been discovered in the subject Altec/Osborne lift bucket." The "defect" that Mr. Coleman is referring to are discontinuity and a feature that is common to other exemplars examined in this case. Testing has shown that their presence is not detrimental to the useful service of the part thus by definition these features and not defects.

   In regards to Mr. Coleman's opinion #2, Mr. Coleman again references the surface cracks as "fabrication defects which precipitated fracture and premature failure of the fiberglass man lift bucket." Mr. Coleman has no evidence to support that the extent and level at which the surface cracks are present in the subject platform are sufficient to cause failure under the loading of one operator and accompanying tools.

   In regards to Mr. Coleman's opinion #3, he has no engineering and scientific basis from having conducted only a non-destructive visual examination of the platform to opine that what he believes to be defect was "present at the time the man bucket left control of the manufacturer."

   In regards to Mr. Coleman's opinion #4, he is simply ignoring the condition of the subject platform that showed evidence of significant gel coat cracking, chipping, gauging, as well as spiral cracks on the boom and proceeds to offer a false opinion that "no indication of pre-existing damage that could have adversely affected performance of the man lift bucket, were observed."

   ESI does not agree with Mr. Coleman's opinion #5 and further claims the opposite that failure was caused by excessive side loading caused by the operator, Kurtis Keaschall. Mr. Coleman neglects to note that the decedent was wearing a fall protection device, and violated safety procedure by not attaching a lanyard present on the D-ring of the primary lift structure.

2) Review of John A. Eihusen, P.E., EiCon Services report, *Keaschall Failure Investigation*, dated September 26, 2015.

   ESI has reviewed a report authored by John A. Eihusen of EiCon Services, and ESI does not agree with opinions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 offered by Mr. Eihusen as discussed below.

   In opinions 1, 2, and 3, Mr. Eihusen similar to Mr. Coleman references "flaws" and "defects" in the composite laminate. As previously discussed, this notion is not consistent with the ASM Materials Engineering Dictionary definition of a defect, as discontinuities are present in composite parts, and if accounted for in the design process, are not detrimental to a safe service life. Testing has shown that the at-issue platform model exhibits strength well in excess of its working load and, in fact, well in excess of its designed safety factor of 12 times the working load.

Mr. Eihusen does not provided an engineering or scientific basis for his opinions 4 and 5 regarding the source of the discontinuities in the subject platform. As previously discussed, discontinuities and voids are present in composite products as a matter of course (as they are in virtually all materials), and do not inherently constitute a defect or detriment to the strength and life of the component, given adequate design provisions.

Eihusen opinion 6 does not take into account the evidence observed in the at-issue platform that is consistent with an applied side overload. Eihusen opinion 7 attempts to suggest that the composite platform was compromised as opposed to the catastrophic failure of the bucket being triggered by excessive side loading.

Eihusen opinions 8 and 9 do not take into account the substantial damage and cracking observed in both the subject boom and platform. The extent of this damage is sufficient cause for evaluation and repair of the primary structure.

Opinion 10 neglects to note that there is a redundant structural component in the form of a D-ring provided to directly attach the operator to the primary boom structure to protect the user in the event of a platform incident. This D-ring was not in use by the operator at the time of the incident and would have restrained the operator and prevented the fall to the ground.

Opinion 11 does not address the fact that both single event and fatigue testing has been conducted by Altec, showing that overloads well in excess of the design working load, as well as 100,000 cycles of fatigue loading at twice the rated platform capacity did not produce failure of the platform. The material of construction was appropriate given the design and validation performed by Altec.

In addition, Mr. Eihusen claims Altec did not adequately warn of the dangers of the use of the bucket and the need for periodic inspection. Mr. Eihusen's claim has no merit as the Altec Operator's manual (2004) provides warnings related to the dangers of the use of the platform and instructs occupant to use appropriate OSHA approved personal fall protection system. Statements related to warnings can be found on page 17, page 19 and page 26.

Conclusions

Based on our investigation, education, training and experience, ESI has reached the following conclusions to a reasonable degree of engineering certainty:

1. The root cause for the failure of the fiberglass platform on the Dawson Power truck is overloading from the side of the platform causing the catastrophic failure.

    a. The fracture occurred at the same location as an exemplar bucket that was tested in side loading.

    b. There is damage in the form of gel coat cracks at the corners of the bucket that is consistent with side loading.

c. There is damage observed on the boom in the form of spiral cracks indicating excessive loading.

2. The fiberglass platform involved in this accident Altec Part # 07040054 is not defective in its design, manufacturing, or material. The platform is not unreasonably dangerous for its intended use.

   a. Altec performed testing to relevant industry standards. Altec tests 100% of the platforms in conformance with applicable ANSI standards.
   b. The test data on similar platforms show that the platform has a safety factor in excess of the 12x the rated capacity of 700 lbs in the direction of normal loading.
   c. The composite material properties requirement of Altec are common of materials for this application.

3. The presence of subsurface discontinuity and or surface micro-cracking in the rim should not be considered a defect as it is a manufacturing discontinuity that appears to be present in platforms manufactured by Osborne Industries.

   a. As shown by the testing conducted on exemplars with this discontinuity the platforms passed the stability test conducted at 1050 lbs or 1.5X the 700 lbs load capacity.

   b. The cracking and subsurface discontinuity was present in every platform examined by cutting and/or x-ray imaging.

4. The fall of Mr. Keaschall could have been prevented had Mr. Keaschall properly attached a lanyard securing himself to the D-ring intended for this purpose, which remained attached to the section on the upper boom.

The above represents ESI's opinions as of the date of this report. ESI reserves the right to modify our opinions in this matter as new information becomes available.

End of Report Text

<u>Attachments</u>
Appendix A — CV of Author
Appendix B — Rule 26 of Author

Appendix A

CV of Anand R. Shah, M.S., M.B.A., P.E.

ESI

4215 Campus Drive
Aurora, IL 60504

ANAND (ANDY) R. SHAH, M.S., M.B.A., P.E.
SENIOR MANAGING CONSULTANT
arshah@engsys.com

As a Senior Managing Consultant and a Director of the Polymer practice, Mr. Shah oversees materials and analysis personnel and related work across offices of Engineering Systems Inc.

Mr. Shah conducts and leads investigations on the performance of products made from plastics, composites, and elastomeric materials for use in diverse applications. He specializes in product failure analysis, material characterization testing, investigations on the appropriateness of the choice of materials for their intended application, evaluating the influence of processing parameters on product performance, and in evaluating product design. He has published his work in numerous technical journals and is a co-author of Fractography in Failure Analysis of Polymers book.

In his 20 years of experience, he has evaluated incidents related to product, systems, and component failures in plumbing, transportation, construction, electrical, oil and gas, chemical processing, medical, and consumer industry. His experience also includes investigating formulations of polymers in paints, coatings, adhesives, and in lubricants. He utilizes the study of interpretation of fracture surface features (Fractography) and principals of structure property relationship in polymers to provide solutions to plastic product performance and service life issues. Mr. Shah has provided testimony in matters pending before both state and federal courts.

Areas of Specialization

Plastic Failure Analysis
Material Selection Consulting
Product Design Evaluation
Chemical Compatibility Testing
Analytical Testing
Mechanical Testing
Environmental Stress Cracking in Plastics
Fatigue and Fracture Mechanics
Creep and Stress Rupture of Plastics
Service Life Prediction
Non-Destructive Testing and Inspection

Education

B.S., Biomedical Engineering, Case Western Reserve University, Cleveland, Ohio, 1995
M.S., Macromolecular Science, Case Western Reserve University, Cleveland, Ohio, 1997
M.B.A., Business Administration, DeVry University, Chicago, Illinois, 2003

Licensed Professional Engineer (P.E.)

IL (062.058788)

January 2016

Professional Affiliations

- Society of Plastics Engineers (SPE) Member
- American Society of Testing and Materials (ASTM) International Member
- Society for Biomaterials Member
- Society for Advancement of Materials and Processing Engineering (SAMPE) Member

Honors and Awards

Chairman for Failure Analysis and Prevention Special Interest Group of Society of Plastics Engineers for Annual Technical Meeting in Orlando, Florida, 2014-2015

Technical Program Chair (TPC) for Failure Analysis and Prevention Special Interest Group of Society of Plastics Engineers for Annual Technical Meeting in Orlando, Florida, 2012-2013

Moderator of Failure Analysis and Prevention session at Society of Plastics Engineers (SPE) ANTEC meetings – 2000, 2009, 2010

Reviewed papers for Journal of Applied Polymer Science, Journal of Material Science, Society of Plastics Engineers and Society for Biomaterials conferences

Positions Held

- Engineering Systems Inc., Aurora, Illinois
  Senior Managing Consultant, 2015 to Present
  Senior Consultant, 2010 to 2015

- Illinois Institute of Technology, Chicago, Illinois
  Adjunct Faculty, MMAE Department, 2014 – Current

- Packer Engineering, Inc., Naperville, Illinois
  Director, Materials Engineering, 2005 - 2010

- Bodycote Polymer Broutman Lab, Melrose Park, Illinois
  Manager, Materials Testing, 2000 – 2005

- Broutman and Associates, Chicago, Illinois
  Senior Research Engineer, 1997 - 2000

Publications

"Computed Tomography X-Ray Imaging – A Technique for Non-Destructive Examination of Plastic Products," Society of Plastics Engineers Annual Technical Conference, Orlando, Florida, March 2015, with J. G. Jordan and Dr. A. Richards

"Determination of Environmental Stress Cracking Failure Mode in Investigation of CPVC Fire-Suppression Sprinkler Pipe Failures," Proceedings of the Society of Plastics Engineers Annual Technical Conference, Orlando, Florida, April 1-4, 2012, with D. B. Edwards

"Failure Analysis of Plastic Crimp Fitting Assemblies," Proceedings of the Society of Plastics Engineers Annual Technical Conference, Boston, Massachusetts, May 1-5, 2011, with D. E. Duvall and D. B. Edwards

"A Discussion on Prevention of Plastic Product Failures," Society of Plastics Engineers Annual Technical Conference, Orlando, Florida, May 2010

"The Effect of Marking Paint on Walking Surface Slip Resistance," International Conference on Slips, Trips and Falls 2007: From Research to Practice, August 2007, with D. G. Curry, R. Reinke and J. Kidd

"Role of Finite Element Analysis – A Computer Aided Engineering Technique in Failure Analysis of Plastic Products," Proceedings of the 12th Annual International Conference on Industrial Engineering Theory, Applications, and Practice (IJIE'07), Cancún, Mexico, November 2007, with K. Nakamoto and B. Agarwal

"Characterization of Continuous Fiber Reinforced Chemically Bonded Ceramic Composites," Materials Science & Technology 2006: Ceramic Matrix Composites, Cincinnati, Ohio, October 2006, with M. Pareek, J. Rigsby and B. Agarwahl

"Significance of Creep Rupture and Stress Relaxation Data in Product Design and Material Suitability Evaluation," Annual Technical Conference of Society of Plastics Engineers, May 2005

"Prediction of Service Life in a Chemically Active Environment Using Stress Rupture Data," Journal of Applied Medical Polymers, Autumn 2000, Vol. 4, No. 2, pp. 88-93, with Dr. P. K. So and L. J. Broutman

"Mechanical Strength Properties of Silicone Gel Filled Breast Prosthesis after Explantation," Sixth World of Biomaterials Congress Meeting, Kamuela, Hawaii, May 2000

"An Alternative Method for Determining the Hydrostatic Design Basis for Plastic Pipe Materials," Proceedings of the International Plastic Pipe Symposium, Goteborg, Sweden, September 14-17, 1998, with L. J. Broutman, E. F. Palermo, and D. B. Edwards

"Stepwise Fatigue Crack Propagation in Polyethylene Resins of Different Molecular Structure," Journal of Polymer Science: Part B: Polymer Physics, Vol 36, pp. 2355-2369 (1998), with Dr. A. Hiltner and Dr. E. Baer

"Fatigue Acceleration of Slow Stepwise Crack Growth in Polyethylene Pipe Materials," International Symposium on Plastic Piping Systems for Gas Distribution, October 1997, with Dr. A. Hiltner and Dr. E. Baer

"Study of Polyethylene Pipe Resins by a Fatigue Test that Simulates Crack Propagation in Real Pipe," Journal of Materials Science, April 1997, with Dr. A. Hiltner and Dr. E. Baer

"Correlation of Fatigue Crack Propagation in Polyethylene Pipe Specimens of Different Geometries," International Journal of Fracture, September 1996, with Dr. A. Hiltner and Dr. E. Baer

"Correlation of Fatigue Crack Propagation between Compact Tension and Real-Pipe Geometry," Society of Plastics Engineers Annual Technical Conference, May 1996, with Dr. A. Hiltner and Dr. E. Baer

Book Contribution

"Fractography in Failure Analysis of Polymers," Elsevier ISBN 978-0-323-24272-1with Dr. Michael D. Hayes and Dale B. Edwards.

"Strength of the PC-SAN Interface as Determined by Delamination of Polymer Microlayers," a chapter in Interfacial Aspects of Multicomponent Polymer Materials, with Dr. A. Hiltner and Dr. E. Baer

Technical Presentations

Instructor for Failure Analysis and Prevention Annual Seminar Course offered by Society of Plastics Engineers and Bodycote Materials Testing, 2000-2004

"Introduction to Fiber-Reinforced Plastic Composites" The Lewis University, Romeoville, Illinois Adjunct Professor, 2010 to 2013

"Failure Analysis of Plastic Gas Piping"
U.S. Department of Transportation, Transportation Safety Institute/PHMSA Seminars on Pipeline Failure Investigation Techniques, 2014 – 2015

Instructor for Failure Analysis and Prevention Annual Seminar Course offered by ESI, June 2015

Appendix B

Anand R. Shah, M.S., M.B.A., P.E. Testimony List

ANAND R. SHAH, M.S., M.B.A., P.E.

TESTIMONY LIST

Mr. Shah's 2016 billing rate is $325/hour

October 20, 2011
Ann L. Ballenger, individually and as administrator of the Estate of Thomas Ballenger deceased v. Sikorsky, Bell, Aeronautical Associates and Edwards Aircraft Corporation a Foreign Corporation
In the United States District Court for the Middle District of Alabama Northern Division
Case No. 2:09-CV-72-MHT
Representing: Aeronautical
Deposition Testimony

December 19, 2011
Dairyland Power Cooperative v. Merrill Iron & Steel, Inc., Wausau Business Insurance v. Papco Industries, Inc., The Boldt Company, et al.
State of Wisconsin Circuit Court, Marathon County, Branch 5
Case No. 09-CV-1030
Representing: The Boldt Company
Deposition Testimony

September 21, 2012
Davide Della Valentina, et al. v. Product Partners, LLC, d/b/a Beachbody and B-Lines and Chubb Insurance Company
United States District Court, Eastern District of Louisiana
Case No. 2:11-CV -02135-ILRL-DEK
Representing: Lifeline USA, LLC
Deposition Testimony

October 1, 2012
Linda DeJana, et al. v. Marine Technology, Inc., et al.
United States District Court, Eastern District of Missouri
Case No. 4:11-CV-1690-JAR
Representing: Estate of Kevin Graff and Philip DeJana
Deposition Testimony

December 18, 2012
American Polymers Corporation v. Polystar Products, Inc. v. Mervis Industries, et al.
Superior Court of New Jersey, Law Division: Mercer County
Docket No: Mer-L-2149-08 **Consolidated** with Mer-L-617-09; Mid-L-7457-09; and Bur-L-3854-09
Representing: American Polymers Corporation
Deposition Testimony

ANAND R. SHAH, M.S., M.B.A., P.E.

TESTIMONY LIST

Mr. Shah's 2016 billing rate is $325/hour

January 14, 2013
American Polymers Corporation v. Polystar Products, Inc. v. Mervis Industries, et al.
Superior Court of New Jersey, Law Division: Mercer County
Docket No: Mer-L-2149-08 **Consolidated** with Mer-L-617-09; Mid-L-7457-09; and Bur-L-3854-09
Representing: American Polymers Corporation
Deposition Testimony

March 15, 2013
Donna Reed v. City of Georgetown, Kentucky, et al
Commonwealth of Kentucky, Scott Circuit Court, Division 1
Civil Action No: 07-CI-814
Representing: Buckhorn Inc.
Deposition Testimony

April 30, 2013
Meyer Chatfield Aviation Services LLC v. Cessna Aircraft Company
In the United States District Court, for the Eastern District of Pennsylvania
Civil Action No: 12-cv-03266-TJS
Representing: Cessna
Trial Testimony

December 19, 2013
Dan Wilson v. E&B Giftware LLC & Sports and Leisure Tech, et al.
In the Circuit Court of Cook County, Illinois, County Department, Law Division
Civil Action No: 10-L-3286
Representing: E&B Giftware
Deposition Testimony

January 29, 2014
Linda DeJana, et al. v. Marine Technology, Inc., et al.
United States District Court, Eastern District of Missouri
Case No. 4:11-CV-1690-JAR
Representing: Estate of Kevin Graff and Philip DeJana
Trial Testimony

2015
No Testimony

ANAND R. SHAH, M.S., M.B.A., P.E.

TESTIMONY LIST

Mr. Shah's 2016 billing rate is $325/hour

March 23, 2016
Christianson Air Conditioning and Plumbing LLC v. Continental Homes of Texas, L.P. v.NIBCO, Inc., et al.
In the District Court of Travis County, Texas, 261st Judicial District
Case No. D-1-GN-14-000962
Representing: NIBCO, Inc.
Deposition Testimony